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CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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CONTENTS

A WATCHMAN OVER COMPUTERS

Moscow IZVESTIYA in Russian 1 Dec 85 p 2

[An article by V. Kornev, chief of the computer center of the Ust-Kamenogorsk Road Construction Institute, followed by a commentary by V. Shchepotkin, personal correspondent of IZVESTIYA, Ust-Kamenogorsk.]

[Text] Today, it is clear to everyone that decisive acceleration of scientific and technical progress is impossible without broad and effective use of computers in all branches of the economy. With this aim, as is known, the country is planning the output of a new generation of computers.

However, the effectiveness of computer technology depends not only on its quantity and quality but also on how it is exploited in the economy. Even with the present unsatisfactory level of saturation of the economy with computer technology, a huge reserve for increasing the effectiveness of computers lies hidden here.

At present, in a single Eastern Kazakhstan oblast (but it would be more precise to say basically at Ust-Kamenogorsk), there are 15 computer centers. Each of them has available one or two computers. very expensive for our time, costing from 500,000 to several million rubles. This does not even take so-called small technology into consideration. As you see, in this connection, possessors of computers already have large expenses. Later I will tell you also about other expenditures, also very impressive, but for the time being let us dwell on these fundamental ones and let us look at whether they justify themselves. Today's computers should work three shifts and operate 5-20 hours a day. Only then will their existence be effective and proven economical. And here is what the work load is for several computer centers in Ust-Kamenogorsk. At the silk fabric combine, a YeS-1035 computers has been installed since March 1983. Its cost was over a half-million rubles. The average daily work load of this expensive aggregate during the first half of the present year was 1.2 hours. The same kind of computer works even less -- a total of 1.1 hours a day -- at the Kazgiprotsvetmet Institute. There is a similar picture at some other computer centers.

Understanding the absurdity of such a position, they try here and there to load the machine with nothing other than the simplest of tasks, which could be successfully accomplished by a microcalculator. That is, the computer is transformed into an adding machine.

Why does this happen? Because, following the fashion, managers of certain organizations and enterprises were not thinking about business but about prestige. Unfortunately, their superior officials followed the lead of their subordinates in arrogant pretense. Somehow, can't we stop looking at computers as if they are expensive toys? With this kind of computer utilization, there will never be enough of them, no matter how many industry puts out. Moreover, after a few years, the machine becomes outdated, and it needs to be replaced, with the investment of large funds and without receiving the necessary pay-off. The more so as direct and indirect expenses are not limited to the cost of the computer itself. Expensive housing has to be built for it, equipped with air conditioning, sprinkler systems, and so forth. Personnel are needed for the computer center itself, and specialists in computer service and repair. And what is now happening with this repair and service?

To handle this work, the country has a network of organizations. Each one specializes in a definite type of computer in the region attached to it. As far as, on the one hand, they are not always concerned on site with creating favorable conditions for the work of these sections (good locations are lacking, personnel are not provided quarters, and the supply and equipment base is weak) and, on the other hand, the number of possessors of these computers that sprout up without business to do is growing rapidly, so specialists of such organizations begin sometimes to establish their procedures so that they are very inconvenient to computer possessors. Here is one example. In the contract between our institute and the Ust-Kamenogorsk section of SoyuzEVMkompleks is written the following: the average time of arrival for disposition of a breakdown is 4 hours, and the average time for disposition of a breakdown is 7.5 hours. With the cost of each hour of machine time at 80 rubles, this makes 920 rubles. But the question arises as to why it takes exactly four hours to reach the institute and not two or seven? During this amount of time, you can go around the perimeter of the city two times. They cannot explain this. If you don't want to have centralized service, don't use it, we have enough other clients.

Why is there this kind of relationship between computer-possessors and service organizations? It is all because of this: the abundance of underworked computers. Having been ordered about and snowed under with excuses, the computer center made a decision: to create its own staff of service personnel and by hook or by crook to begin to look for the means and search out the people. Where? They are all in those specialized organizations, enticing engineers with the opportunity to obtain living quarters and, most important, work where they do not have too many troubles. And what kind of duties are there for a shift electronics engineer in a small computer center consisting of one or two machines? Operationally, he can dispose of insignificant malfunctions, but if this can't be done, he calls a representative of the service organization. As a result, the computer center personnel are 20-30 percent employed, and a qualified engineer turns into a computer watchman.

What is the way out of this absurd, paradoxical situation? Where there is a whisper of life, there is a way. That is the unification of all the many "rebel" computer centers into a single collective. Whether it is at the oblast, the city, or some other level is unimportant. The main thing is that it should be a union of people who are working on and not just standing around the machines. It can operate under the aegis, let us say, of the oblast civil administration and on a cost-accounting basis. That is, machine time would be sold and, insofar as such time may be expensive, what used to pop up on the computer would no longer be processed.

The creation of collective computer centers will increase effectiveness in the use of computers and, at the same time, will lower material expenditures. In addition, expenditures to acquire software will be reduced. If now, for example, to acquire the Spektr program package costs each departmental computer center 20,000 rubles, a collective computer center would pay this sum only once for all customers.

Simultaneously, the service of computer equipment also will be improved. Then, there will be full return for both the computers and the engineers, who belong to a scarce specialty and who not fulfill a rather non-prestigeous role -- that of computer watchmen.

Comment by a Personal Correspondent of IZVESTIYA

The problem about which V. Kornev, electronic engineer and candidate of engineering sciences, speaks is actually very topical. The idea of computer centers for collective use is already beginning to take shape in individual oblasts, and there are constantly increasing numbers of advocates for it.

"Such centers are very advantageous economically," said S. Bushev, the deputy head of the All-Union Association, Soyuzmashinform of the USSR Central Statistical Administration, "They are all on cost-accounting and are all profitable. Therefore, by the end of the present five-year plan, there will be 14 more regional computer centers for collective use directly under the supervision of the USSR Central Statistical Administration.

A collective center can service not only those organizations that can afford to buy computers even if they do not have a large workload, but also those that are not able to acquire a computer even though they have a need for information processing. These are organizations of an agro-industrial complex, trade and public nutrition, and cultural institutions. As it is being said, the hands of the computer centers of oblast civil administrations do not always reach down to their needs, because the machines of these centers are worked to the limit. Thus, putting order into computer use is an urgent problem of the times and has been reflected in the draft Basic Directions for the Economic and Social Development of the USSR for 1986-1990 and for the period up to the Year 2000. This most important document directly states: "To continue the creation and increase the effectiveness of computer centers for collective use . . . "

Who should put order into this business?

A few years ago, when there were few computers produced in the country, the necessity for installation of a computer in a particular organization was coordinated with the USSR Central Statistical Administration. Now, questions on the distribution of computers are within the authority of USSR Gosplan and, partially, Gossnab of the country. It is they, if one can say it, who have the punch-cards in their hands.

9645/12947
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WITH THE HELP OF AUTOMATION

Tallinn SOVETSKAYA ESTONIYA in Russian 12 Oct 85 p 3

[Article by B. Sandratskiy]

[Text] Several months ago a technical operations center (TsTE) was put into operation at the Tallin municipal telephone system.

At present, I am meeting with the head of the TsTE Viktor Golfman and the head of the plant laboratory of the municipal telephone system (GTS) Aleksandr Nozdrev, and I got interested in the improvements in subscriber services brought about by the new center. And it seems that the positive changes are many.

The center ensures the technical operation of the automatic technological process control system (ASUTP) which in turn is comprised of five subsystems. Each has its own tasks and title. "Tsensor" controls the exchange and line equipment. "Tetra" is engaged in supervising the status of interexchange service and traffic. "Kati" evaluates the operation of the whole telephone system. Continuity testing by test ringing is accomplished by "Dolli." And "Pentaks" is engaged in the management of pay telephone operation.

"Kati" and "Tetra" are unique in their own way. Up until recently they were used only in Tallin, but now they are used also in Smolensk and Ustinov.

The authors of these developments are the engineers at the Tallin laboratory of the Moscow branch of the Scientific Research Institute of Communications (MONIIS) and the designers at the ESSR Ministry of Communications, who together with telephone system specialists participated in the installation of the new center.

What practical benefits were gained in this case of the creative collaboration of these three organizations?

With "Tsensor," the time to eliminate malfunctions at various municipal ATS [automatic telephone exchanges] was significantly decreased. The telephone staff now identifies the problem sooner than even the subscribers do, because the maintenance staff instantly receives the information from Tsensor and very quickly restores the ATS equipment to proper operation.

"Kati," "Dolli," and "Tetra" are concerned with improving the quality of telephone calls. It is interesting that earlier methods of continuity testing by test ringing were manual and involved two switchboard operators. This work was monotonous and required tremendous attention and endurance. So, because of the great stress, errors appeared. "Dolli" eliminates such situations.

As for "Pentaks," this subsystem has as yet not been fully implemented. But already the effect of its use is very considerable. If one considers that previously there were 5-7 percent inoperative pay telephones in Tallinn, a pretty good indicator is that now these numbers are down to 2-4 percent. "Pentaks" is already connected to 650 pay telephones. During 1986, this subsystem will manage the operation of all 1,300 pay telephones of the GTS.

"Pentaks" provides a means of solving another, especially acute problem that previously confronted the Tallinn telephone staff. This problem relates to the numerous cases of malicious damage to the pay telephones. In one year these losses amounted to 15-17 thousand rubles.

With the installation of "Pentaks," those lovers of sharp feelings, which were transferred to the pay telephones "equipment-wise," will find that this is unacceptable. That is, the new subsystem instantly reacts to a case of malicious damage to telephones. In a few seconds the appropriate information is received by the GTS dispatcher, who immediately informs the militia. The "subscriber" has just begun to damage the pay telephone, and already behind him tands the militia detail....

It is known that in Shyaulyay, Pskov, and some other cities of our country there are already systems for paying for use of the telephone on a time basis. That is, the longer the call, the more the charge for the call. In Tallin, such a method of charging is projected for 1988. The new technical operations center will assist the telephone staff greatly in this regard.

Many contributed to the development and installation of the center: Candidate of Technical Sciences E. Kuusk (Tallinn laboratory MONIIS); engineers of the ESSR Ministry of Communications design office S. Bukovskiy, A. Kulman, and A. Neyterman; GTS engineers Ye. Domrin, A. Nozdrev, and V. Shibalov. At the present time, the next one of these centers is being developed. Economists have calculated that when all of these subsystems are fully installed and equipped, their economic impact will be 152.1 thousand rubles per year.

[Picture caption: Viktor Golfman and Engineer Tatyana Ruban by the new equipment]. Photo F. Klyuchika

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CSO: 1863/114

TRANSITION TO NEW SYSTEM OF PLANNING AND ECONOMIC STIMULATION (CONFERENCE-SEMINAR)

Moscow VESTNIK STATISTIKI in Russian No 6, Jun 85 pp 70-72

[Article by Z. Savinova]

[Abstract] At the end of 1984 a conference-seminar attended by regional (oblast, kray and autonomous republic) unit directors of computer services, planning department heads and chief accountants was held in Vladimir. It considered the computer network of the Central Statistical Administration (TsSA) of the RSFSR and the conversion to a new system of planning and economic stimulation. Since January 1983 computer centers in Kuibyshev, Volkhov and Leningrad were converted on an experimental basis and the process was extended to the entire network of the RSFSR TsSA as of 1 January 1985. The objective is to increase the economic efficiency of the computer centers, improve accounting procedures and more fully utilize resources. The brigade system for stimulating labor efficiency was introduced. In four years of the 11th Five-Year Plan measures were taken for the third phase of the Automated System of State Statistics, 17 new systems and 3 regional complexes were introduced, and 22 complexes were converted from Minsk-32 machines to Yes computers. More than half of the statistical indicators are now computer generated. Work is continuing on computerized processing of social and demographic sampling data collected in 1985. The computer system of the RSFSR TsSA serves more than 40,000 enterprises and automated accounting has been introduced into 940 agricultural enterprises, 287 budget department bureaus and 173 consumer cooperative organizations and in all kolkhozes and sovkhozes in 28 rayons of the Leningrad and Moscow oblasts. In comparison with the corresponding period of the 10th Five-Year Plan, the work value increased by 40% due to better labor productivity. Collective use computer center networks are to be built up on the basis of local computer centers. The improvements will be introduced without increasing the staff through improved productivity. The question of standards for the evaluation of the work of the computer centers was discussed among other aspects of the improved operation of the network. [441-12497/12947]

MANY PROBLEMS OF COMPUTERIZATION REMAIN UNSOLVED

Moscow PRAVDA in Russian 28 Aug 85 p 1

[Abstract] The editorial calls attention to problems that must be solved to ensure the success of the nationwide program for the development, production and efficient use of computer technology and automated systems, which was endorsed by the Politburo of the Communist Party Central Committee. It observes that despite the fact that some good practical experience has been amassed in developing and introducing computers in certain spheres of production and management, there remain many unresolved questions which are said to be due largely to lack of coordination among agencies.

The editorial says there is a serious problem with standardization of computer hardware and software. The electronics industry, the radio industry, and the instrumentation industry are producing computers and peripheral equipment of various classes and series which are said to be far from compatible. This lowers the efficiency of machine use and poses obstacles to the creation of unified industry and regional computer systems. Too many algorithmic languages are used in compiling computer programs. Also, there is said to be much duplication of efforts, and there is no effective system for identifying and publicizing the best programs. It is said that there is a serious need for improving the system of servicing computer technology. The service association "SoyuzEVMkompleks" and similar organizations reportedly do not extend services to many computers that are in operation, and the level of their services is said to be less than adequate.

The editorial also addresses problems of inefficient use of computers, including use of computers for simple accounting and calculating tasks, and of training specialists to work with computers.

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CSO: 1863/58

BRIEFS

COMPUTER DESIGNS CARPET PATTERNS--Workers at the "Mistr" Manufacturing Association of Nonwoven Materials in Tallin assumed their socialist duties in honor of the 27th congress of the CPSU. One of these duties stipulated the manufacture in the fourth quarter of a new experimental batch of carpets with an eight color computer designed pattern. New equipment allowing for the use of the SM-1800 computer was developed in conjunction with the Cybernetics Institute. All patterns are stored in the computer's memory so that changes can be made almost effortlessly. Thus an opportunity has arrived to more fully satisfy consumer demand using the resources provided by industry. ["Computer Draws Pattern"] [Text] [Tallin SOVETSKAYA ESTONIYA in Russian 12 Oct 85 p 1] 13150/12947

NEW COMPUTER COMPLEX IN UZBEKISTAN--In Tashkent the biggest collective use computer center in Uzbekistan is under construction. The opening of this mighty complex will provide for the collection under "one roof" and unified management of the best specimens of modern computer technology, the organization of a library of programming methods, as well as the opening of various types of information "banks" and systems for general use. All of this will provide the opportunity to considerably improve the management of the republic economy. The center is being built by a team of fitters from the Construction and Installation Administration's 11th "Special Reinforced Concrete Building" Trust "Vysotstroy" under the leadership of Mukhtar Khabibullayev, a deputy of the republic Supreme Soviet. ["House for Computers"] [Text] [Moscow IZVESTIYA in Russian 31 Oct 85 p 1] 13150/12947

NEW AUTOMATED HEALTHCARE SYSTEM IN MOLDAVIYA--Electronics will help to more successfully conduct the annual public health checkup of the inhabitants of the Kamensk region. A central automated system for the health care of the population has been installed in the local health clinic's department of preventitive medicine. All data on a patient, including the results of all tests he has undergone are now being entered into the electronics memory of a computer. The computer requires less than ten minutes in order to ascertain a patient's physical condition and, when necessary, make recommendations as to what kind of physician he should consult. Previously such an examination required at the very least several days. However the new system gives more than just a time advantage. The great precision with which it processes information will enable medics to more efficiently diagnose an illness when it is still in the early stages and thus treat it in time. Such central automated systems will be installed in the near future in a number of health

clinics in Kishinev, Belts and Bender. [By I. Koretskiy] ["Computer in a White Coat"] [Text] [Kishinov SOVETSKAYA MOLDAVIYA in Russian 24 Sep 85 p 2] 13150/12947

NEW COMPUTER CENTER IN FRUNZE SCHOOL--The first academic computer center went into operation in Frunze school 61. Scientists and teachers of the Frunze Polytechnical Institute, with whom the school has cooperated for the last seven years, helped to set up the center. It all started when the institute's computer laboratory started the "Young Programmers" club. More than 1,700 of the school's graduates received a computer programming certificate in addition to a secondary school diploma. [By "Sovetskaya Kirgiziya" correspondent V. Chernyshev under the "News" rubric: "Dialogue with a Machine"] [Text] [Moscow PRAVDA in Russian 5 Jan 86 p 3] 13150/12947

CONFERENCE DISCUSSES ASU DEVELOPMENT--On October 23 in Tashkent the All-Union Scientific-Technical Conference on Hardware, Software and Algorithmics for Automated Management Systems concluded work. Representatives of ministries, departments, scientific institutions, institutions of higher education and businesses from Moscow, Leningrad and all the union republics examined the problems of development and introduction of ASU and computer-aided design. They also discussed issues of efficiency increase in scientific research in this field. "Uzbekistan was not chosen as the conference site by accident," remarked V. V. Solodovnikov, doctor of technical sciences, professor and department chairman in the N. E. Bauman Higher Technical College in Moscow. "The republic has gained experience in the introduction of ASU on canals and in other hydro-electric installations. Automated systems provided for the more logical use of water resources, as well as significantly facilitating the process of allocation of irrigation waters. The Uzbek Industrial Association "Cybernetics" in conjunction with the Tashkent Polytechnical Institute of the Order of Friendship among Peoples are conducting important work in this area. Recommendations intended to coordinate the efforts of scientists and specialists in solving the problems of efficiency increase in ASU application. ["ASU: Hopes for Development"] [Text] [Tashkent PRAVDA VOSTOKA in Russian 24 Oct 85 p 3] 13150/12947

CSO: 1863/113

FIFTH GENERATION COMPUTERS

Riga NAUKA I TEKHNIKA in Russian No 8, Jul 85 pp 8-10

[Article by Vladimir Andreyevich Redko (Cand. Tech. Sc.), laboratory superintendent at the LaSSR Academy of Sciences Institute of Electronics and Computer Technology: "Fifth Generation Computers;" first two paragraphs are in boldface and are NAUKA I TEKHNIKA introduction]

[Text] The next generation of computers is challenged to reach a level of information processing which is commensurate with the potential of the human intellect. They should "learn" to converse with the user in the user's natural language, be able to accumulate knowledge, make complicated decisions, and perform expert assessments.

VLADIMIR ANDREYEVICH REDKO (born 1829, in Dzhalalabad) is the laboratory superintendent at the LaSSR Academy of Sciences Institute of Electronics and Computer Technology. He graduated from the Riga Higher Military Aeronautical Engineering School in 1953. In 1965 he defended his dissertation and was awarded the degree of Candidate of Technical Sciences. His scientific interests span computer networks and information systems.

One would be hard-pressed to name one single area of the national economy which has no use for computer technology. However, a number of unresolved problems are hampering the increasingly efficient utilization of that technology and further developments in the automation of various spheres of human activity. So, for instance, special programming knowledge is required to make extensive use of computers belonging to the current generation. Another substantial obstacle is the specific nature of input-output systems, which cannot usually handle such normal forms of human interaction as speech and visual images. The frequent upshot of all this is that a development engineer (a computer user) can formulate problems from his field of specialization in a natural language (in his professional idiom) but cannot use a machine to help solve those problems. He must perforce call upon systems analysts to construct a mathematical model of the problem as formulated, programmers to actualize the model in program format, and operators to run those programs on a computer. This naturally causes a drastic loss of momentum in the process of designing and introducing various systems which make use of computer technology and limits that technology's sphere of application.

The appearance of minicomputers, microcomputers, microprocessors and ultimately of personal computers during the past 10 to 15 years and the creation of computerized informational networks makes these tasks easier. The development of computer technology is moving in the direction of simplified programming (the invention of high-order languages), less expensive minis and micros which are no less productive than before, input-output modes (alphanumeric and graphics displays, plotters, devices for graphic material input) which are more user-friendly, and opportunities for large numbers of users to tap into powerful data processing network resources.

This avenue of development, however, may reasonably be termed evolutionary. A more far-reaching solution calls for a shift to a qualitatively different level of computer "intelligence," to direct user-machine rapport which is not "mediated" in any way. What is needed for this to happen? It is not necessary to "elevate" the user to the level of professional knowledge possessed by systems analysts and programmers. Instead, the functions which they presently perform must be executed (simulated) by the computer itself. This implies that the user should be able to interact with the machine in a natural-language professional idiom (speech-based input and output), with back-up from textual and other graphic documentation.

The problems involved in simulating this sort of human activity lie within the purview of that subsection of cybernetics which deals with artificial intelligence. It must be said that research along these lines is being conducted on a broad scale now, both in this country and abroad. Who has not heard, for example, of contests between man and machine or of "duelling machines?" Computers are learning to speak; robot technology is developing by leaps and bounds. There exists a widely-established variety of information systems. All this, together with achievements in the field of microelectronics, has obliged specialists to turn their minds to the creation of qualitatively new fifth generation computer systems--computers which will listen to and understand speech, translate from one language to another almost as fast as the text can be read, understand the meaning of visual input (maps, photographs, handwritten documents), search various storage areas for randomized information, and solve problems which exhibit at least a partial lack of definition.

Japanese scientists were the first to take on this entirely concrete task. In 1979, a committee for research into and development of fifth generation computers--machines created expressly to achieve a level of information processing which is commensurate with that performed by the human brain--was set up in Japan.

The program has a 10-year time frame. It is planned to produce computers with the capacity to perform logical operations and make decisions at some point between now and 1989.

We shall now look at the conceptual schema for fifth generation computer systems which is currently very prevalent in the literature. In a rather stylized rendition, this computer system would consist of user, simulation software, and actual computer system (hardware base). The user "converses"

with the computer in a natural language (in a professional idiom), using a dialogue mode and employing textual and other graphic documentation. He formulates the problem for the machine and verifies the solution it reaches.

Direct contact with the user is accomplished by means of a hardware-software system which analyzes and synthesizes speech-based and graphic input and which is supported by its own software and knowledge base. In essence, a knowledge base (in contradistinction to a data base) not only contains concrete data (facts) but also includes the patterns which link them. It is a model of the field in question. In addition to the requisite selection of words and elementary graphic images, a knowledge base of this kind, as part of the input-output system, should contain the analytic and synthetic patterns of the user's natural language and also of graphic images.

The simulation software system consists of intelligent software and a knowledge base. Its chief task is to bring the user into direct interaction with the computer. Its central module should, to all intents and purposes, simulate (and supplant!) the activity of systems analysts and programmers.

How does a systems analyst work? He constructs a mathematical model, enlisting the regularities evident in a particular problem-sector and drawing on the relevant areas of mathematics and the principles of modeling. He evaluates alternative variants and makes his decisions in accordance with the specifications he has been given. In a fifth generation computer, these functions are assumed by the software and the knowledge base of the appropriate problem-sector. The knowledge base contains not only a selection of data in the functional area but also the patterns that characterize discrete fragments of the model and the rules upon which inferences are drawn and deductions and decisions are made. Basing itself on this information, the software performs the simulation, achieves contact with the user, updates its problem-solving experience, and so forth.

The system, furthermore, actualizes the mathematical model by translating it into a programming language. At this point the knowledge base contains, in addition to the patterns that characterize this process, a selection of usable programs and subroutines, and the methods whereby they may be assembled and optimized.

The hardware of these systems consists of two kinds of machines--those which perform the functions involved in problem-solving and logical deduction and those which host the data base and the symbolic and digital processing functions.

There is, therefore, a qualitative difference between fifth generation computers and their predecessors from earlier generations, whose job has merely been to process digital input. The complex battery of problems which stand in the way of a fifth generation breakthrough may be illustrated by some examples drawn from the Japanese project.

Problem-solving and logical deduction systems must include machines whose productivity stands at or around one billion logical deductions per second.

In view of the fact that one logical deduction equates to between 100 and 1000 of the operations performed by a contemporary computer, the productivity of existing machines will obviously have to be increased by several orders of magnitude.

The knowledge base management system should be capable of storing and retrieving on the order of 20,000 rules and 100 million statements. This requires a 100-gigabyte memory.

The needs of machine translation systems, in addition to an embedded vocabulary of 100,000 words, encompass a knowledge of grammar, of the rules of sentence construction, and more. And speech recognition systems should be capable of processing and understanding approximately 10,000 words and of generating complex linguistic structures.

For image recognition, a machine will have to retain 100,000 picture elements and to access information in a tenth of a second.

The creation of such devices is linked to new studies in the most diverse spheres of human knowledge. The primary problem is that of the methodology of knowledge presentation. This is the central dilemma faced by artificial intelligence. No less complex is the development of logical deduction and decision-making hardware and software media. A set of specialized programming languages, known as the languages of logical programming, must exist before these problems can be solved. PROLOG, a language that was first proposed in 1972, is the present prototype of those languages.

A no less important factor is increased system productivity. The traditional approach here is to boost the operational dispatch of individual units. This cannot, however, go on forever: there are limits to signal propagation speed. Scientists are investing great hopes in logical programming languages which can make use of parallel processing, because this will make it feasible to execute data streams simultaneously and in parallel, on different processors--to create, that is, highly productive multiprocessor systems. (This kind of parallel processing is exceedingly complicated to perform on contemporary computers.) However, the rise in the number of processors contained in a system and the need to increase computer memory capacity impose new and rigid requirements upon the microminiaturization of hardware elements, and upon design technology and production techniques. The first desideratum in tackling these challenges is automated design systems for large-scale and very-large-scale integrated circuits [LSIC, VLSIC], with densities as high as 10 million transistors per chip.

This certainly does not exhaust all the problems involved in the creation of fifth generation computers. The publication of the Japanese project sparked a rash of commentary in the press, and even the most skeptically-minded specialists acknowledge that the project deadlines are the only questionable aspect.

The Japanese project spurred the development of programs for the creation of fifth generation computers elsewhere in the world. The EEC, for example,

has adopted a European agenda of strategic research in the field of information technology, whose project modules have fairly short-term goals. Seven Common Market countries are participating in this European project. A prospective research program in the field of information technology adopted in England has a five-year time frame. Work on the creation of fifth generation computers in the USA is concentrated in four centers, one of which is the Department of Defense.

Work on fifth generation computers actually began in 1982. One year later, the Japanese completed the development phase of the core unit for a personal computer (PSI) designed to provide software support for the projected machines. This is a machine with the capacity for sequential inference. It is, in essence, the first step toward the creation of a computer which can solve problems and draw logical inferences (though it lacks, as yet, parallel processing architecture). It is claimed that the machine will perform 20,000 logical inferences per second and that its on-line storage will accommodate 1 million words.

Software development has been based upon PROLOG, a logical programming language. Meanwhile, work has begun in Japan on the creation of an experimental model which uses parallel processing to draw logical inferences and whose software synthesizes programs automatically, contains decision-making programs and interfaces intelligently with the user.

American specialists are devoting considerable attention to development work on production technologies for gallium arsenide integrated circuits, which are notable for their high operating speeds, low power consumption and good radiation resistance. It is expected that the use of GaAs integrated circuits in fifth generation computers will boost their productivity by three to four orders of magnitude.

Work has been proceeding on speech-based input-output devices for about 10 years now. Most of this work is, however, still experimental. These devices as yet have meager vocabularies of no more than 100 words. As a rule, these machines are still incapable of recognizing "continuous" utterances and have to be calibrated for a particular operator ("speaker").

Issues surrounding the development of computer technology and computerized information processing are receiving a lot of attention in this country too. At a general session in 1983, the USSR Academy of Sciences set up a Department of Informatics, Computer Technology and Automation. Several new institutes have been established to address the problems of microelectronic technology and the production of high-purity materials. Academy and branch institutes have been working on several versions of a supercomputer with productivity rates as high as 300 million operations per second. An automated VLSIC design system is in the making, and small but high productive computers, personal computers and microelectronic elements based on new physical principles are currently under development.

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SYSTEM FACILITIES FOR FUNCTIONAL DIAGNOSTICS OF SINGLE-BOARD MICROCOMPUTER

Kiev UPRAVLAYASHCHIYE SISTEMY I MASHINY in Russian No 4, Jul-Aug 85
(manuscript received after revision 14 Aug 84) pp 34-38

[Article by I. Z. Kominarov, Leningrad; A. V. Samoshchenko, Donetsk Polytechnical Institute; S. V. Teplinskiy, Leningrad Engineering Technical Institute; and A. A. Shkola, Leningrad]

[Abstract] The design of a system for diagnostics of a single-board microcomputer which is a precondition for automated debugging is considered. The microcomputer has self-testing capacity using test programming routines which can determine gross malfunctions but this is possible only if the device retains a certain level of functional capacity, while logic and signature analyzers are not sufficient because of circuit complexity. The proposed system involves linking the microprocessor to an external computer with a buffer memory, registers and a cycle counter. The diagnostic procedure first determines the cycle of the failure and then the computer operator interacting with the system carries out steps for localizing the defect in the microprocessor within a precision of one element or a link between elements. Diagnosis is possible because the computer, simulates the operation of the microcomputer in the form of a system of commands and improved speeds are possible if the computer is command-compatible with the tested unit. Standard values for the microcomputer cycles are compared with the test routine results. To save time, test routines are broken up into segments, each of which has standard values so that particular segments can be tested. Figures 2; references: 4 Russian.
[431-12497/12947]

COMPUTER CHIP STORES 2 MILLION UNITS OF INFORMATION

Moscow TRUD 27 Sep 85 p 2

[Text] Scientists of the Donetsk Physical-Technical Institute of the Ukrainian Academy of Sciences have been able to place up to 2 million units of information on a crystal the size of a postage stamp.

A miniature instrument developed in Donetsk is capable of storing and reproducing information without the aid of complex mechanical devices.

A large number of the crystals can be 'packed' into the compact body of this instrument, which allows the storage capacity to be substantially increased.

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CSO: 1863/58

WORK ON MAGNETIC SEMICONDUCTORS

Kishinev SOVETSKAYA MOLDAVIYA in Russian 19 Oct 85 p 2

[Article by V. Tezlevan, scientific leader of the young scientists' collective of the Moldavian Academy of Sciences' Institute of Applied Physics]

[Excerpt] At the Moldavian Academy of Sciences' Institute of Applied Physics, magnetic semiconductors are being studied in the laboratory of semiconductor compounds. We set ourselves the task of studying single crystals of magnetic semiconductors and of developing a process for obtaining these materials with reproducible characteristics and optimum properties. To do this, a group including the young associates V. Tsurkan, K. Nikiforov, V. Buzhor and A. Merkulov was formed. Later it grew into the young scientists' collective, which encompassed on an equal footing associates of our institute's Special Design and Technological Bureau of Solid-State Electronics and its experimental plant. We worked on the technology of growing single crystals of magnetic semiconductors, studying their properties and determining their applications; in other words--we developed a finished product with specific recommendations as to where and for what purpose it should be used and where it could be applied in industry.

Our work has received high praise. The USSR Ministry of the Electronics Industry took an interest in our results, and we have begun to do research on a contract basis for its enterprises.

Applications have been used in a number of industrial trials. Their practical use has produced an economic effect of 314,000 rubles.

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CSO: 1863/58

MANAGING THE MULTI-INSTITUTE PROJECT ON 5TH GENERATION COMPUTERS

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 4, 2-15 Jul 85 p 6

[Excerpt] A temporary (three years) scientific-technical team called "Start" was established in April 1985. Its participants are based at the Computer Center of the Siberian Branch of the USSR Academy of Sciences (the chief organization), the Computer Center of the USSR Academy of Sciences, the Estonian Academy of Sciences Cybernetics Institute, and at industry research institutes and design bureaus. The goal of this team is to perfect the components of the fifth generation of computers and to conduct their experimental testing.

The director of the "Start" team, Doctor of Physical-Mathematical Sciences V. Ye. Kotov, deputy director of the Computer Center of the Academy of Sciences' Siberian Branch, commented on the project:

"The transition to the fifth generation is impossible without radical improvement of all of the things that make up computer technology. Everything must be updated: the component base, means of communication, software, and primarily machine architecture. We already have R&D accomplishments that measure up to the task in practically every area. Interesting results, for example, have been obtained in concepts of new computer architecture at the Siberian computer center; hardware has been developed at an industry research-and-production association, and problems of higher machine intelligence have received intensive study at the Estonian academy's Cybernetics Institute.

"It was necessary to pool the efforts of groups of researchers and developers which are under different agencies, because we could arrive at the desired result in a sufficiently short period of time only through their joint work. How was this to be done?

"The solution was suggested by the August 1983 resolution of the Communist Party Central Committee and the USSR Council of Ministers 'On Measures for Accelerating Scientific-Technical Progress,' which pointed out the expediency of creating temporary inter -industry scientific-technical teams (VMNTK) for solving key economic problems. The practical implementation of this idea was facilitated by the January 1985 joint resolution of the USSR State Committee on Labor and Wages and the All-Union Central Council of Trade Unions 'On Procedures for the Payment of Wages and Bonuses for Workers of

Temporary Teams...,' which set rules for their work and gave to them the necessary legal and business status.

"Insofar as I am aware, 'Start' is the first attempt to make use of the possibilities afforded by this resolution.

"The workers who make up our team are working on assignments under a unified program while remaining essentially at their own places of employment. In the first stage, their goal is to create mock-ups of experimental prototypes of the main components of fifth-generation computers. In doing this, they are using the scientific and production areas and resources, the machine time and other support services of the participating base organizations.

"Naturally, not everything is going smoothly as of now. Experience shows that directives alone are not sufficient for the practical participation of a base organization in the work of the VMNTK. It is evident that certain changes in the economic mechanism are needed to ensure the interest of organizations in the progress and results of the work of the temporary team.

"Moreover, the system of managing the VMNTK still is not flexible enough: it is difficult to maneuver the staff of specialists, the wage fund, and sub-contracting and specialized work. For example, in the course of research, as some problems are solved and others arise, there may be needs for new specialists and for changing the professional structure of the team. But it is difficult to transfer headquarters from one organization to another, because this requires agreement by many parties."

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AWARD NOMINATION FOR 'ISKRA-226' PERSONAL COMPUTER ENDORSED

Moscow IZVESTIYA in Russian 2 Oct 85 p 2

[Article by Ye. Velikhov, academician]

[Abstract] The author writes in support of the USSR State Prize nomination for the work on development and introduction of the "Iskra-226" family of dialog minicomputers. He relates that the "Iskra-226" was developed to meet a need for personal computers with which users themselves could work without special training. Organizations of the USSR Academy of Sciences, the Ministry of Instrument Building, Means of Automation and Control Systems, and the USSR State Planning Committee reportedly have been working on the development of such minicomputers for use in automation of planning, management and scientific research. In series production since 1981, the first machines of the "Iskra-226" family went into service in the State Planning Committee and at institutes of the Academy of Sciences, according to the author. He notes that at biology institutes, for example, the computers are being used in standard automated systems for conducting physical-chemical research, and that a national data bank of biopolymer structures has been created on the basis of "Iskra-226" computers. The operations that can be performed with the machine reportedly include text compiling and editing, drawing and plotting of graphs, data storage and retrieval, and control of production processes and scientific experiments. Various peripheral devices are said to be available for the latter functions.

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PRIZE RECIPIENTS FOR PROBLEM-ORIENTED COMPUTER COMPLEXES

Leningrad LENINGRADSKAYA PRAVDA in Russian 17 Nov 85 p 1

[Abstract] Photographs are given of four Leningrad residents who received the 1985 USSR State Prize for development and introduction of a family of problem-oriented computer complexes based on "Iskra-226" minicomputers. The four are Boris Petrovich Butrin, former deputy director of the All-Union Scientific Research and Design Institute of Systems of Numerical Programmed Control; Sergey Nikolayevich Abramovich, head of a sector of the "Burevestnik" Research and Production Association; and two employees of the "Sever EVM Kompleks" (north computer complex) producton association--Irina Yevgenyevna Shklyarova, head of a bureau, and Valentin Yevgenyevich Kuznetsov, head of the association's design bureau.

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UDC 621.374.3.062.8:621.391.23

STUDY OF THE POSSIBILITY OF THE TRANSFER OF BINARY CODED INFORMATION THROUGH A CHAIN OF SWITCHES CONNECTED IN SERIES

Tbilisi SOOBSHCHENIYA AKADEMII NAUK GRUZINSKOY SSR in Russian Vol 118, No 1, Apr 85 p 141-142

[Article by M. B. Voskoboinik, M. S. Oganov, B. L. Shekhter, G. A. Kabisashvili, presented by Academician V. K. Chichinadze on June 28, 1983: "Study of the Possibility of the Transfer of Binary Coded Information through a Chain of Switches Connected in Series"]

[Text] In digital logical units, binary coded information transfers through chains of switches connected in series. It is apparent that information may be transferred through chains without distortion by using switches whose transfer characteristics show a distinct separation of logical levels 0 and 1 and a high noise immunity [1].

Recently, attempts to design digital systems based on switches whose transfer characteristics do not show a distinct separation of logical levels 0 and 1 have been reported [2], however.

This work is dedicated to determining the conditions under which the transfer of information through such chains of switches is possible.

The transfer characteristic of a switch without a distinct separation of logical levels 0 and 1 is shown in figure 1, curve 1. For generality, we will consider chains which contain an infinite number of switches, and approximate the transfer characteristic with two rectilinear segments (fig. 1, curve 2).

We designate:

α_1 as the angle of inclination of the first segment,

α_2 as the angle of inclination of the second segment,

$(V_{вх_0}, V_0)$ as the point of intersection of the segments,

$(0, V_1)$ as the point of intersection of the first segment with the y-axis,

$(0, V_2)$ as the point of intersection of the extension of the second segment with the y-axis.

Later, we will consider switches for which $k_1>1$, $0<k_2<1$, which corresponds to real characteristics.

With these assumptions in mind, the mathematical model of the transfer of information through chains of switches may be written in the form

$$U_n = f(U_{n-1}) = \begin{cases} V_1 - k_1 U_{n-1} & \text{при } U_{n-1} \leqslant V_{вх_0}, \\ V_2 - k_2 U_{n-1} & \text{при } U_{n-1} > V_{вх_0}, \end{cases}$$

where U_n is the value of the output voltage of the nth switch.

We consider the sequence $U_n(n=0,1,2,\ldots)$. Here $U_0=U_{BX_1}$ is the input voltage of the first switch and U_1 is the output voltage of the first switch, which is the input voltage of the second. The sequence $U_n(n=0,1,2,\ldots)$ is determined in the following manner: U_0 is some point on the segment $[0, V_2/k_2]$, $U_{n+1}=f(U_n)$. In order for this sequence to be determined for every value of U_0, it is sufficient that the inequality $V_1 \leq V_2/k_2$ have a locus, which is always satisfied in practice.

Let us point out several properties of the given sequence:

1. If $U_2 \geq U_0$, then the sequence $U_{2n}(n=0,1,2,\ldots)$ is not decreasing, and the sequence $U_{2n+1}(n=0,1,2,\ldots)$ is not increasing. On the other hand, if $U_2 \leq U_0$, then the sequence $U_{2n}(n=0,1,2,\ldots)$ is not increasing, and the sequence $U_{2n+1}(n=0,1,2,\ldots)$ is not decreasing.

2. The limits $p=\lim_{n\to\infty} U_{2n+1}$ and $q=\lim_{n\to\infty} U_{2n}$ always exist and are finite.

3. p and q satisfy the relations $p=f(q)$, $q=f(p)$.

All possible values of the transfer characteristic parameters of a switch k_1, k_2, V_1, V_2 were considered, given these restraints, and the dependencies of the output voltages p and q of the entire chain on the input voltage of the first switch U_{BX_1} were determined. These dependencies are essentially the transfer characteristics of the entire chain.

For values of the transfer characteristic parameters of a switch which satisfy each of the three following conditions:

1. $k_1k_2=1$, $V_2>k_2V_1$,

2. $k_1k_2>1$, $V_2>k_2V_1$,

3. $k_1k_2<1$, $(1+k_1)V_2 \geq (1+k_2)V_1$,

we obtain the transfer characteristics shown in figure 2. The output voltage of the entire chain does not in this case depend on the input voltage of the first switch, i.e., the logical information is lost during transfer through such a chain.

For values of parameters of the transfer characteristic such that $k_1k_2>1$ and $V_2=k_2V_1$, we obtain the transfer characteristics of the chain shown in figure 3. When the voltage $U_{BX_1} = 0$ is fed into the first switch, the output voltage for a chain with an odd number of switches equals V_1, but for a chain with an even number of switches equals 0. When $U_{BX_1} = V_2/k_2$ is fed in, the voltage upon exit from the chain equals 0 or V_1 depending on the odd or even number of switches. For all other values of U_{BX_1}, $p=q=V_2/(1+k_2)$. Likewise, for every deviation of input of logical levels from the values 0 and V_2/k_2, the logical information is lost during transfer through the chain.

For values of the parameters of the transfer characteristic which satisfy the condition $k_1k_2=1$, $V_2=k_2V_1$, we obtain the transfer characteristics in figure 4. In this case p and q depend continuously on U_{BX}, without a separation of logical levels 0 and 1. Distortion of logical information is possible during transfer through the chain.

For values of parameters of the transfer characteristic of a switch which satisfy the condition $k_1k_2<1$, $(1+k_1)V_2<(1+k_2)V_1$, (*) we obtain transfer characteristics for the chain shown in figure 5, where

$$U^0 = \frac{V_2-k_2V_1}{1-k_1k_2}, \quad U^1 = \frac{V_1-k_1V_2}{1-k_1k_2}.$$

It is obvious that for these characteristics the logical levels 0 and 1 are distinctly separated. During transfer through such a chain, information is neither lost nor distorted, and the noise immunity of the entire chain is higher than that of a single switch.

From this analysis of the mathematical model, it follows that a digital unit design based on switches whose transfer characteristic does not show a distinct separation of logical levels 0 and 1, but which satisfies the conditions of (*) is possible.

[Captions accompanying figures]

Figure 1. Transfer characteristic of a real switch (1) and its approximation (2).

Figure 2. Transfer characteristic of a chain of switches when one of the following conditions is satisfied: 1. $k_1k_2=1$, $V_2>k_2V_1$, 2. $k_1k_2>1$, $V_2>k_2V_1$, 3. $k_1k_2<1$, $(1+k_1)V_2 \geq (1+k_2)V_1$.

Figure 3. Transfer characteristic of a chain of switches where $k_1k_2>1$, $V_2=k_2V_1$.

Figure 4. Transfer characteristic of a chain of switches where $k_1k_2=1$, $V_2=k_2V_1$.

Figure 5. Transfer characteristic of a chain of switches where $k_1k_2<1$, $(1+k_1)V_2<(1+k_2)V_1$.

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UNIVERSAL MODULE FOR INTERFACING ELEKTRONIKA D3-28 WITH PERIPHERALS

Kiev UPRAVLAYUSHCHIYE SISTEMY I MASHINY in Russian No 4, Jul-Aug 85 (manuscript received after revision 26 Oct 84) pp 38-39 cont. on 88

[Article by Yu. A. Narezhnyy, I. L. Myshkin and Ye. N. Vasina, Lvov Polytechnical Institute]

[Abstract] The Elektronika D3-28 is a small unit with tape storage, indicator and keyboards used in measurement systems. It connects to printers, paper tape punches, photoelectric counters, etc. but the available interfaces are specialized for certain purposes or specific peripheral units. A universal module was developed which can connect with commutators, signal generators, digital/analog or analog/digital converters, external memories, digital frequency meters or digital voltmeters and microcomputer controllers. The device has asynchronous programmed input/output, interrupt input/output and input/output with direct memory access. The universality of the module is obtained through the adaptation of the control programs in the peripherals and the setting of the module address on the control bus decoder. The module is a single printed-circuit board (330 X 180 X 1.5 mm) using K133, K533 and K585 series microcircuits and functions with several measurement instruments in automated systems and also with a microprocessor prototype based on the K580IK80 processor with the Elektronika D3-28 connected in for debugging the microcontroller.
[431-12497/12947]

UDC 519.6

MATHEMATICAL PROBLEMS IN THE ASSIMILATION OF SUPERCOMPUTERS

Moscow VYCHISLITELNYYE PROTSESSY I SISTEMY in Russian 1985 (signed to press 21 Jan 85) pp 3-12

[Article by V. V. Voyevodin]

[Abstract] The introduction of supercomputers involve problems concerning computer architecture in relation to the structures of the problems treated,

algorithms and languages which can be formulated as the problem of the mapping of the algorithm on the computer system architecture. At the present time, mathematicians use machine-independent algorithmic languages which can work on different types of computers and they do not have to necessarily understand the operation of the machines. Costs are high, amounting to several tens of dollars per machine instruction, because most programs need adaptation to the particular machine, while the algorithms do not exactly represent the mathematical processes and often do not have the required precision. The mathematician using a multi-machine system often does not initially know which machine provides the solution and there is a great deal of variety in the program approaches. The problem of the distortion of mathematical characteristics is especially acute now because of the appearance of fifth-generation supercomputers. The previously used languages had structures resembling those of the machines, but supercomputers incorporating several hundred simultaneous processors, which perform parts of several operations in order to realize pipeline functioning, are limited as to the classes of problems dealt with and general-purpose programs cannot be used. Optimum speeds for synchronous pipeline computer systems, depending upon the number of component processors and the processor loads, are given by a periodic linear algorithm with a complete set of operations in the period; and the effectiveness of the system is determined by the degree to which this can be obtained. Such algorithms are found to be possible because mathematical problems can usually be broken up into parts and can be handled by repeated passes. Vector-type computations, as on the Cray-1 supercomputer, characterize systems with constant links between conveyor mode processors and relate to the machine realization rather than to algorithm structure. It is shown that it is possible to simultaneously construct problem algorithms and define the supercomputer structure with respect to the necessary number of links to the memory, throughout capacity, the required number of memory cells and other factors. Random structure algorithms are generally not possible but, in practice, algorithms are not of this type. The algorithms under consideration for supercomputers are always of the parallel type and it is essential to develop programs which can automatically break up algorithms into parallel forms. For the investigation of algorithms for supercomputers it is found that pipeline systems of specialized processors are superior to parallel systems of universal processors. References: 6 Russian.
[445-12497/12947]

UDC 681.51.015.26

SIMULATION OF SINGLE CHIP MICROPROCESSORS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian No 5, Sep-Oct 85 (manuscript received 1 Aug 83, after revision 5 Jun 84) pp 32-35

[Article by V. V. Vlasova and O. V. Moguyeva]

[Abstract] The basis of any specialized simulation system for microprocessors is a library of models of the components that describe their operation and

are oriented toward the execution of a particular class of tasks. This paper describes a set of models in such a simulation system for the design of microprocessors based on the K580IK80 miltiprocessor, including mathematical models of the K580 series of microprocessors, the ROM, buffer register and bus driver. The creation of microprocessor models is broken down into seven steps, extending from the determination of the time intervals for instruction execution in terms of the clock cycles and the detailing of microprocessor functions in each time segment to the definition of the set of modules characterizing microprocessor operations on the group of instructions for similar functions at the various points in time as well as the detailed description of the actual contents of the functions performed by the microprocessor in the execution of each particular instruction. The microprocessor component models described here are in fact the basis for a library of a specialized simulation system intended for the design of single chip, fixed-word-length microprocessors using the K580IK80. A set of program modules in FORTRAN-IV was developed for the specialized simulation system and is realized with the SM-4 minicomputer within the framework of the RAFOS operating system. Figures 1; references 13: 3 Russian, 6 Western, 4 Western in Russian translation. [32-8225/12947]

BUREAU BUILDS INSTRUMENTS FOR TESTING SEMICONDUCTOR PRODUCTS

Alma-Ata PRAVDA VOSTOKA in Russian 1 Oct 85 p 3

[Excerpt] Developing instruments for scientific research is the job of the Uzbek Academy of Sciences' Central Planning, Design and Technological Bureau of Scientific Instrument Building. Among the customers for the instruments that it builds are the electronics institute and physical-technical institute of the republic's Academy of Sciences, central academy and industry scientific institutions, institutes of academies of sciences of other republics, and foreign firms.

Instruments for investigating physical phenomena in semiconductors are in large demand. In the years of the 11th 5-year plan, the bureau has developed and turned over for use 26 types of instruments. They are being used for measuring the type of conductance and resistivity of semiconductors by the four-zone method and by the method of spreading resistance, and for measuring volt-ampere and volt-farad characteristics of semiconductor structures. The bureau has developed a number of special devices for automatic control of the temperature of objects being studied in cryostats. The instruments "Kristall-3" and "Shlif-150" substantially accelerate and heighten the quality of monitoring of processes of diffusion, applying epitaxial layers, and other micro-electronics production processes.

Considerable work has been done by the bureau to help in introducing instruments at industrial enterprises of the country.

One of the bureau's latest developments is a "conductance-type identifier" (OPT-2), which is intended for determining the type of conductance of semiconductor materials. It has no counterparts in Soviet industry. A study of the demand for this instrument revealed that it is very high among semiconductor-products plants, research institutes, industry laboratories and higher educational institutions which work in the field of semiconductors.

The design bureau's production facilities, however, are not sufficient to permit it to fulfill all of the orders that it receives for the instruments which are regarded so highly in both science and industry. The design bureau needs an experimental plant.

In the light of the new tasks for accelerating technological progress in the 12th 5-year plan, more intensive plans are being outlined. They call for

strengthening production facilities, for doing extensive preparatory work or transferring instruments that are developed to a new component base involving microprocessor technology, and for undertaking a transition to series production.

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LASER R&D AT ESTONIAN PHYSICS INSTITUTE

Tallinn SOVETSKAYA ESTONIYA in Russian 19 Oct 85 p 2

[Article by Kh. Moppel, (interviewers)]

[Abstract] The article is an interview with Doctor of Physical-Mathematical Sciences Peeter Saari, director of the Estonian Academy of Sciences' Institute of Physics in Tartu. Saari comments on directions of research at this institute and on problems of speeding the introduction of its developments.

Saari reports that two-thirds of all the institute's research is financed by business contracts. The institute is said to hold a leading position in research of optical recording of information; interaction of infrared, light and gamma radiation and x-radiation with matter; and problems of energy conversion in nuclear-particle systems, crystals and biological molecules. Saari recalls the study of methods for storing information in crystals and retrieving it by means of light beams began at the institute more than 10 years ago, under the direction of K. K. Rebane, corresponding member of the USSR Academy of Sciences and currently president of the Estonian academy, and Ch. B. Lushchik, corresponding member of the Estonian academy. In the field of information science, work which the institute is doing on new and more efficient component bases has earned international recognition and a USSR State Prize nomination. It is noted that Rebane reported on some of the institute's latest research results in this field at an international conference in the United States early in September.

Saari relates that lasers of the newest types are being developed in the institute's laser technology sector, which is headed by Candidate of Technical Sciences V. Mikhkelsoo. Unique lasers that are smaller than the head of a match have been developed in the institute's semiconductor sector, under the direction of Candidate of Physical-Mathematical Sciences P. Lyuk. Scientists of the institute are collaborating with the Estonian academy's Special Design Bureau in the development of new instruments, including high-powered lasers.

In conclusion, Saari assesses progress in improving the institute's ties with specialists in other fields, particularly medicine. He mentions that R. Tamkivi, a physicist of the institute, has defended a candidate dissertation on the use of lasers for studying biological systems, which has prospective applications in medical research. Saari reports that a proposal is

being drafted for creating a joint research center at which semiconductor lasers and other promising developments of the physics institute would be prepared for industrial introduction. He says that a research center with strong resources also is needed to promote the broad introduction of new types of medical equipment, including tunable lasers which are under development at the physics institute.

(A photograph of Saari is given.)

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UDC 681.3.06

EXPERIENCE AND PERSPECTIVES FOR CENTRALIZED SUPPLY OF PROGRAMMING FOR AUTOMATIC CONTROL SYSTEM DEVELOPMENT

Kiev UPRAVLAYUSHCHIYE SISTEMY I MASHINY in Russian No 4, Jul-Aug 85
(manuscript received after revision 25 Feb 85) pp 9-14

[Article by A. N. Popsuyev, Tsentrprogrammsistem]

[Abstract] A survey is made of 10 years of experience with the Central Fund of Algorithms and Programs (TsFAP) created at the Tsentrprogrammsistem Scientific-Production Association in Kalinin for the supply of standard programs to developers of automated management systems which is now serving more than 3,000 enterprises and organizations especially in connection with the Soyuzsistemprom All-Union Industrial Association. It was found that the supplied software was not always appropriate for the required purposes and in 1975-1979 more than 60% of the users had to make several requests for additional programming for certain tasks. Developers' effectiveness can be improved by enhancing the quality of TsFAP programs and by the supply of program maintenance facilities to the users. Third-generation computers began to be used by developers in 1975, at which time Tsentrprogrammsistem supplied the necessary maintenance. From 1976-1979, little maintenance was supplied because of increased demand. During 1974-79, some users did not try to introduce the obtained software; this was unprofitable for the state. After a change in planning and incentives work was done only with groups that would really introduce the software, many users (universities, scientific research institutes and design bureaus) were dropped, and some programs were eliminated from the TsFAP. It is important to supply maintenance involving consultations and specialized intervention in order to attain results. The problem is whether to distribute many programs without maintenance or to reduce the number of users. Many developers now create their own software and the Tsentrprogrammsistem could eliminate duplication and waste by creating country-wide standard programs. It is very important to establish a unit of measurement and this could be one machine command but this would not reflect quality. Most TsFAP programs are for industrial uses (machine-building) but it would be useful to develop other types of control systems although it was found that such standard programs have few users (3-5 requests per year) while a profitable level is reached only at 10 or more requests per year. It would be useful to compile a list of tasks whose complexity is such as to

require a program controlled operation. An on-line software data base was introduced in 1983 and over 10 years Tsentrprogrammsistem had over 15,000 program installations, which, it is said, shows their use in ASU.
[431-12497/12947]

UDC 681.3

SIMULATION OF IMAGES OF THREE-DIMENSIONAL SCENES USING TRIANGULATION

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian No 5, Sep-Oct 85
(manuscript received 10 Oct 83, after revision 16 Jan 84) pp 102-103

[Article by Yu. P. Shevelev, V. N. Kirsanov and V. A. Ostrinskiy]

[Abstract] Real-time line-by-line scanning algorithms are optimal for the removal of the surfaces of the objects in three-dimensional scenes that are invisible from the observation point at some particular time. The heuristic nature of these algorithms requires additional data on the configuration of components of a scene in order to eliminate the invisible surfaces. There is an increasing practical need for the consideration of the depth of perspective in terms of two-dimensional projections. This can be done using triangulation (stereoscopic vision) to reflect the information about the depth of field of the three-dimensional scene. The mathematics of this approach based on simple triangulation geometry is described here. The method has been successfully used as the basis of a triangulation algorithm to eliminate invisible surfaces when processing the projections of three-dimensional images consisting of arbitrarily shaped polyhedra. A FORTRAN-IV algorithm for the SM computer series processed initial data that included a structural description of the scene by means of specifying the sets of vertices, edges, sides and colors of the faces of the polyhedra. The image stereopair was generated by means of direct perspective transformation of the set of vertices with the subsequent generation of the projections of the edges by means of analytical geometry applied to the structural descriptions of the objects. The relevant geometry is sketched and described, though no specific numerical examples are given. Figures 2; references 5: 2 Russian, 3 Western in Russian translation.
[32-8225/12947]

INFORMATION RETRIEVAL SYSTEM FOR COMPUTER PROGRAM ARCHIVE

Moscow MOSKOVSKAYA PRAVDA in Russian 10 Nov 85 p 3

[Article by N. Lazareva]

[Excerpt] An information retrieval system for the archive of literature on published algorithms and programs has been introduced at the USSR State Public Scientific-Technical Library (GPNTB SSSR). This system is the first of its kind in our country.

How much time does a specialist require in order to select literature on a desired topic from an ordinary card file? The electronic catalog can handle this task in two to three minutes; five at the maximum.

In addition to routine retrieval of material, the information retrieval system makes it possible to accomplish a number of new tasks. For example, it has become possible to automate the publication of the monthly index "Algoritmy i programmy" (Algorithms and Programs), using information stored in the computer's memory. The problem of circulating this index on magnetic tape among organizations which have their own computer technology is being solved.

Many specialists are using the archives of the scientific-technical library, which is the largest in our country. Computerized systems are helping them orient themselves in the vast "sea" of books. The accomplishment of tasks for further accelerating scientific-technical progress is also directly connected with the improvement and equipping of information services and libraries. The experience of GPNTB SSSR is therefore of special interest. Technical solutions employed here have been recommended as standard ones in the development of similar systems in other libraries of our country.

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AWARD NOMINATION FOR SOFTWARE FOR AUTOMATION INSTRUMENT SYSTEMS

Moscow IZVESTIYA in Russian 21 Sep 85 p 3

[Excerpt] If one analyzes the development of means of data processing in our country over the past 20 years, what appears most striking is a serious lag in the rate of development of means of programming as compared with the development of electronic technology and computer hardware. The complexity and diversity of tasks that must be solved requires more and more programs of the most diverse types. Being a means of heightening labor productivity in various spheres of activity, industrial data processing itself is in need of higher productivity on the part of its programmers.

A scientific concept formulated by B. Tamm, member of the Estonian Academy of Sciences, and by Candidate of Technical Sciences Yu. Pruuden has become a kind of compass in the maze of data processing. It concerns the integrated use of systems of programs with various problem orientations, and the development of complexes of program-packages of applied systems using instrument systems of programming. Research by E. Tyugu, corresponding member of the Estonian Academy of Sciences, had a great influence on the development of a new process for compiling packages of applications programs. This research and also a number of other fundamental theoretical investigations enabled scientists of the Estonian academy's Institute of Cybernetics to develop two families of instrument systems of programming called "Priz" and "Memo." Today they have become widely recognized and found widespread use as instruments of industrial data processing at enterprises of the electrical equipment and machine building industries, in scientific organizations and educational institutions, and in construction design bureaus.

The work of the collective of scientists of the Estonian academy's Institute of Cybernetics entitled "Development and Introduction of a Complex of Instrument Systems of Programming for Engineering Tasks," without question, is deserving of the USSR State Prize.

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AUTOMATED PROGRAM-COMPILER SYSTEMS 'AL'FA' and "AL'FA-6'

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 4, 2-15 Jul 85 p 2

[Text] For developing and introducing an advanced process and a set of equipment for automated preparation of programs for various computers, academician A. P. Yershov and Candidate of Physical-Mathematical Sciences I. V. Pottosin, heads of laboratories of the Computer Center of the USSR Academy of Sciences' Siberian Branch were awarded a prize of the USSR Council of Ministers for 1985 (among other recipients in Moscow, Leningrad and Kiyev).

On the basis of the systems "Al'fa" and "Al'fa-6", which was developed at the Computer Center of the academy's Siberian Branch, the group of award-recipients developed the methodology of a 'factory' of high-quality compilers, and of collective work with large packets of programs. A very important stage of work has been completed. Future plans call for developing not only integrated means of developing programs, but also new, automated methods of constructing program systems, and also automatic compiling of specific versions of programs from 'multipurpose blanks' that are in the programmer's arsenal.

The first step has been taken toward creation of a system for automation of the programmer's workplace.

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APPLICATIONS

INTERACTIVE AUTOMATED INFORMATION-LOGIC SYSTEM

Kiev UPRAVLAYUSHCHIYE SISTEMY I MASHINY in Russian No 4, Jul-Aug 85
(manuscript received after revision 14 Dec 84) pp 97-103

[Article by A. A. Ros, Yu. G. Bogdanov (both from Kharkov), A. N. Kosinov, M. V. Snopkov, and T. P. Voloshina (last 3 from Taganrog)]

[Abstract] Domestic computer-aided systems such as DISPUT, DILOS and Priz were developed for the design of systems for automated fabrication processes but were not fully successful and were effective only when there was a high level of operator/machine interaction. An interactive automated information-logic system (DAILOS) is presented which is intended for the modeling of complex systems in dynamic environments, recognition of situations and diagnosis of their development, planning of actions for dynamic objects and synthesis of control programs with data processing for system behavior and states. DAILOS has a formal logic procedure which can draw inferences from a set of axiomatic models taking into account system conditions. The basic element is an automated program snythesizer with debugging and optimization of axiomatic models, procedures for logical inferences for action plans, a logic circuit algorithm formulator and a program compiler. The system contains statements written in the input language assigning conditions for system objects and it searches for objects satisfying the conditions, revises its data base and tests hypotheses. Action plans are tree-type inferences as to consequences leading to formulation of logic circuits. The input language (PLATAN-D1) which was selected over PROLOG and SETL, is a first-order predicate manipulation language with model and temporal operators which can describe objects, tasks and processes and action algorithms. An experimental variant of DAILOS was realized on a M6000 computer and its effectiveness was confirmed. The system's evaluation and logical analysis capacities contribute to the program synthesis facilities and after additional work on the operator/machine interaction operations it can be used for expert diagnostic work. References: 14 Russian.
[431-12497/12947]

A DOCTOR'S ELECTRONIC ADVISER

Moscow IZVESTIYA in Russian 19 Oct 85 p 3

[Article by A. Zinovyev, special IZVESTIYA correspondent, Ufa.]

[Text] Mikhail Yefimovich Petrov is a warm advocate of introducing computer technology into the work of medical institutions. To be more specific, he wants to do it at the hospital where he, a doctor of medical sciences, has been chief physician for many years. It is the large hospital of a republic, the leading health institution in Bashkiria. For Mikhail Yefimovich, burdened to the limit with work, the electronic assistant, which contains detailed data in its memory on each patient, on results of physical examinations, and on the course of treatment, and surgical information on the activities of doctors at the polyclinic and hospital and rural hospitals -- such an assistant has appeared to be extremely necessary.

An automated management system section was created at the hospital. This would seem not to be very complicated. But the computer technology question was not so simple -- it is expensive and the acquisition of one is a problem.

"But is it really necessary to acquire it?" pondered Mikhail Yefimovich. "You know, near the hospital, literally a hundred meters away, is the computer center of the Ural-Siberian Administration of the Main Petroleum Pipeline. The equipment can hardly be running twenty-four hours a day . . . "

The doctors came to the administration. And at once they found common language with its specialists. The physicians did not have to search for the three million rubles to acquire computer equipment, and a hundred thousand rubles more each year would be needed to keep it operating . . .

On the desk of the chief physician is a stack of filled-out punch cards, and Mikhail Yefimovich takes one of them. "These are not only comprehensive data, but also objective data on the activities of our institution," says the chief physician. "The initial documents are filled out by workers at the hospital and the polyclinic according to forms approved by the Central Statistical Administration. Whereas previously an opinion might sometimes arise in some subdivision that the chief physician and his deputies might regard a person with bias and "find fault," now, such offenses have become much rarer. The picture has become more objective about how the overall evaluation is put together. This has also become clearer to administration.

Let us suppose that we have a surgeon, Ivanov. Objectively, the volume of his work in recent months consists of the quantity and complexity of the operations performed.

Here, there are data on the complications and the outcome of treatment of each patient operated on. Also taken into consideration, of course, are the social "face" of each associate and his participation in the affairs of the collective.

The new evaluation system moves closer to or permits seeing one's achievements and failures more clearly. For the hospital management, it is very important that the computer automatically puts out information on how busy the hospital beds really are and how long a patient stays in the hospital. Previously, getting such information took a lot of time. The chief physician also receives data on the effectiveness of treatment and on cases of differences in diagnosis between the clinic and the polyclinic. It has become easier, according to section heads, to detect weak sections in a timely way, and discussions of shortcomings have begun to have better results, sensing more realistically what needs to be done first. Briefly, this can be formulated as follows: doctors are helped by the flow of information, not smothered by it.

In addition to the program "ASU-Statsionar" ("Automated Management System - Hospital") which consolidates all this work, the program "ASU-Poliklinika" ("Automated Management System - Polyclinic") also operates at the hospital.

What are the results? On account of improvement and better regulation of hospital examination of patients and other measures accomplished on the basis of computer analysis, the stay of a patient in the hospital (with higher quality treatment) has been reduced on the average by two days. This has made it possible to accept for treatment about four thousand persons additionally every year without a single additional bed. The introduction of the "ASU-Poliklinika" has also brought optimal results.

But the information and computer center of the republic hospital is not only engaged in its own concerns. Each quarter, reports come here about instances of temporary disability and about traumas. These data are received from all fifty-four rural rayons of the autonomous republic. Owing to this, it is possible to conduct continuous analysis of the amount of work loss caused by illness and traumas. It also takes into account the cost of production lost by the state.

"All these facts are not simply analyzed. Results of investigation and proposals for reducing occupational injuries and on disease prevention are discussed at party raykom buros and at rayispolkoms of councils of people's deputies," says the hospital's chief physician. "Our doctors participate actively in discussions. This work is already bearing good fruits."

For the second year at the hospital an experiment is in progress, introducing the brigade form of organization and pay for junior medical personnel -- nurses and comparable personnel. Seven brigades are working in a new fashion. They look after patients in the surgical wards and support cleanliness and order. The participants in the experiment are satisfied -- their material incentive has been increased. The essence is that all wages are distributed, including those of vacant positions. They are paid for work actually done plus a 25 percent bonus for outstanding service. The patients are satisfied with the innovation: at once they have felt both attention and concern.

The old truth has not lost its timeliness: the physician treats, and the nurses bring the patient back to health. And, at times, it is not known which of them are the more important. At the hospital of which we are speaking, they are trying to optimize the labor of both physicians and the middle and junior medical personnel -- on the basis of up-to-date technology and in the name of the people's health.

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THE COMPUTER--AN ALLY OF THE ACCOUNTANT

Kiev PRAVDA UKRAINY in Russian 5 Sep 85 p 2

[Article by A. Kireev, Engineer, Scientific and Technical Branch of "Gorsistemotekhniki"]

[Text] An All-Union conference-seminar on problems related to improving budget accounting and monitoring is taking place in Kiev. On one of the days the seminar participants, leading workers in the financial services of the union republics and some cities and oblasts of the country, visited the Information and Computer Center [IVTs] of the "Gorsistemoteknika" NPO [scientific production association], where they became acquainted with computerization innovations for accounting operations.

Here there were only papers. And they who brought them received others in exchange, in the form of characteristic computer printouts. These contained information that their owners would have spent a week or more to obtain.

The clients of the NPO IVTs are primarily accounting office workers in budgetary organizations. These are schools, kindergartens, hospitals, and Young Pioneer Palaces. The state uses our public funds to support many activities, and for this reason they need to be spent efficiently and economically.

During the Eleventh Five-year Plan the number of educational and public health service institutions in Kiev increased by approximately 25 percent. But the number of workers in their accounting departments did not increase by even one person. When one considers that through these departments several million sheets of accounting and reporting documents pass each year, it is easy to imagine as to how many were handled by their ally, the ordinary computer. In fact, during the last Five-year Plan the computer annually turned out around 1.2 million sheets of primary documents.

Their path through the computer begins with the "input," where in a large room, there is a group of highly-esteemed women seated behind many display screens and who with the speed of fast typists are clicking stroke after stroke. That is the way the clients' information is loaded into the computer memory.

From the room with the greenish screens, the organization of the large mass of numbers takes place in the second stage, in the computer room of the IVTs. The working material-cost accounting files are loaded at 700 strokes per minute. This group of accounting problems the IVTs specialists consider as one of, for the time being, the small number of cases of overcoming departmental barriers. A single program is used to process the data for all material-accounting aspects of the schools, hospitals, kindergartens, and polyclinics. Each register has a specific addressee--the surname of the person responsible for the material. The number of such registers here in a year is more than 40 thousand. And around 10 thousand strokes would have been required to complete such a register for only one school in Kiev.

And nearby on display screens the data of the monthly aggregate balances of the products supplied for all 530 Kiev kindergartens are proofed and corrected. In setting up such a balance the program takes into consideration the seasonal prices of fruits and vegetables, the daily number of children, and many other details.

And finally, the prepared documents are checked against the journal entries for the data received and placed on a table. In the morning the clients, that is, workers in tens of centralized and individual accounting offices in the city, come for the documents.

"We prepare thousands of documents daily," said IVTs Director Yuriy Yevseyevich Kucherenko. "And we even print out for the kindergartens the time sheets for calculating the parental fees to avoid errors, which are inevitable when this is done manually."

"Above all," continued Yu. Ye. Kucherenko, "similar systems form component parts of ISUR--Integrated System of Accounting Operations. This regional, interdepartmental system, a part of the Kiev ASU [automated management system], is now being developed by Branch No. 30 of the head institute of our association. The ISUR system will provide the capability--and its individual components provide this even today--to obtain not only that information that is present in the original data, but also that which can be obtained only by computer analysis of the entire or part of the file. The accounting documents and reports contain most of the information needed for making management decisions; it is only necessary to bring it to light.

Of course, the path of the development engineers to ISUR still has many thorns, very likely, more that a rose. Barriers between departments interfere, because behind these barriers, each department has its own instructions, arrangements, and traditions. In particular, it has not been possible as yet to standardize such tasks, which are so simple today, as calculations of salaries and their payment through the savings bank. The lack of a reliable means of inputting information directly at the workplaces of the finance workers is a hindrance, as is a whole series of other as-yet unresolved problems. But one thing is clear and it is namely this, that although the path is thorny, it is heading in the only correct direction.

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DATABASE FOR AUTOMATED COMPUTATION AND SELECTION OF DRIVE DEVICES FOR AGRICULTURAL MACHINES USING COMPUTERS

Moscow STANDARTY I KACHESTVO in Russian No 9, Sep 85 pp 32-33

[Article by G. V. Vladimirova from the All-Union Scientific Research Institute of Agricultural Machinery Construction and Z. I. Pavlova from the All-Union Scientific Research Institute of Standardization in Machine Building]

[Text] The primary information that is used in the process of designing products of agricultural machine building and is contained in the form of tables, albums, catalogs, certificates and sketches, represents an entire system of current information. The effectiveness of the system and the control organization for supplementing the system depends on the selected database organization.

In solving concrete database problems, the All-Union Scientific Research Institute of Agricultural Machinery Construction [VISKhOM] together with the All-Union Scientific Research Institute of Standardization in Machine Building [VNIINMASh] developed a branch automated information retrieval system based on unified parts and components of agricultural machinery [OAIPS], which is presently functioning successfully. The OAIPS represents a document-factor-graphic information retrieval system [IPS], which may be supplemented because of the organization of data files about products having one functional designation. Such products, for example, are gimbal drives, which may be used as drive devices for agricultural machines.

The database is one of the subsystems for the automated computation and selection of products of agricultural machine building; it creates the necessary base for the working out and making decisions. The connection of the set of problems and information is realized by organizing the applications programs and files in such a way as to automate the derivation of responses to previously formulated queries.

The development of the database subsystem includes:

determination of the type of information and its content;
revelation of basic and supplementary data files and their linkages;

development of algorithms for accumulating, managing and processing data and
selection of the structure of data storable in the memory of a computer and carriers.

The following conditions were observed during the organization of the file: description of the unified parts and components of the agricultural machines by general elements and the possibility of the direct inclusion of files in the automated design process.

Thus, the files of the information retrieval system on gimbal drives is organized by virtue of All-Union State Standard [GOST] 2752-81 "Joints of the Gimbal Drives of Agricultural Machines. Basic Parameters and Dimensions" and All-Union Standard [OST] 23.2.23-80 Cardan Internode Shafts of Agricultural Machines. Types, Parameters and Basic Dimensions." The inclusion of individual data from normative-technical documents in the files makes it possible to automate the process of selecting products from a number of drive devices in which gimbal drives are used, which are unified when conducting strength, kinematics, etc., computations.

To automate reference information for designers and to solve individual questions of the specialization and concentration of production in the OAIPS, data files about the organization/drawing files, production volume, and use of products in agricultural machines are constructed.

Each fact in the OAIPS database system receives its individual formalized description or retrieval pattern. The formalized description of users' information queries makes it possible to obtain a retrieval order. After comparing the patterns with the orders, the factographic IPS gives users the facts that are of interest to them. The factographic retrieval of individual data is easily accomplished through the formalized described document. It is sufficient to note the codes for the identification of the requested data, and the retrieval is executed with 100 percent completeness and precision.

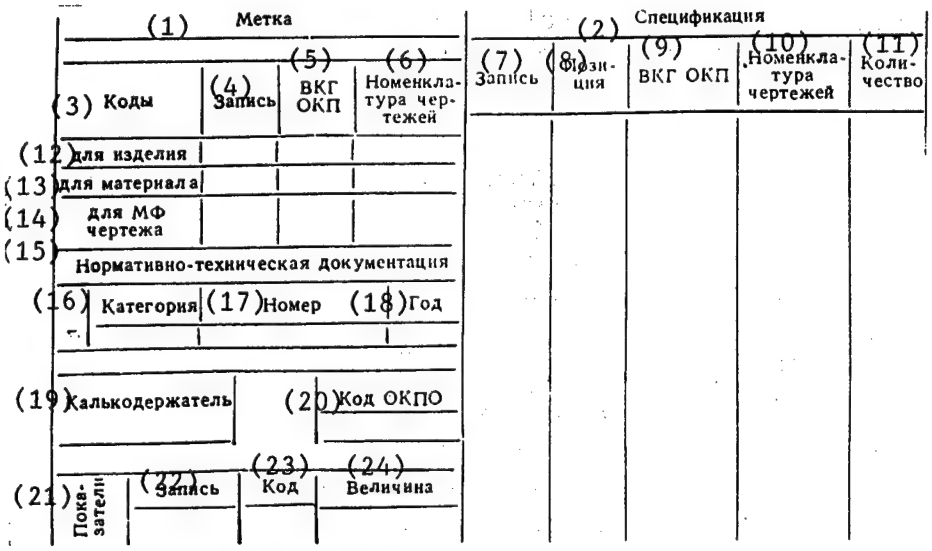
Two information cards (Forms 1 and 2), intrasystem dictionaries of products, parameters and enterprises, and forms of three standard queries were developed for the formalized description of products for the drive devices of agricultural machines.

Data of the formalized description of products that were processed by computer comprise the data files of the information-reference bank [SIF]. The OAIPS applications programs developed make it possible to implement the sorting, correcting, and supplementing of the data of the SIF and also to retrieve data in response to queries.

The first type of query makes it possible to establish whether the database contains information about the product that interests us, to determine the organization of the drawing files of the documentation and, if the product represents an assembled node, to identify its design specifications.

The second type of query makes it possible to select gimbal drives according to computational parameters from a number of products indicated in the state and branch standards.

The third type of query yields data about the application of products in agricultural machines.



Form 1

Key:

1. Label
2. Specifications
3. Codes
4. Record
5. Higher Classification Groupings of the All-Union Classifier of Industrial and Agricultural Information [VKG OKP]
6. Drawing Nomenclature
7. Record
8. Position
9. VKG OKP
10. Drawing Nomenclature
11. Quantity
12. For Product
13. For Material
14. For Drawing Microfilm [MF]
15. Normative-Technical Documentation
16. Category
17. Number
18. Year
19. Drawing Files
20. Unionwide Classifier of Enterprises and Organizations [OKPO] Code
21. Indexes
22. Record
23. Code
24. Quantity

The following are implemented on the basis of SIF:

automated computation and selection of the optimal variant of drive device;

receipt of information that is necessary for the solution of problems of the unification, concentration and specialization of production, and

receipt of intrasystem dictionaries after the sorting and correcting of information.

This information retrieval system is implemented in algorithms for the geometric, climatic and strength computation of drive devices or agricultural machines. For this, the source data and IPS data are formed into tables according to the statements of the designer. In the design process, the designer stipulates a number of limitations (for example, the allowable number of transmitted torques, the maximal rotational frequency, the maximal angle of incline of the shafts of the joint, etc.).

(1) Коды для изделия	(2) Запись	(3) ВКГ ОКП	(4) Номенклатура чертежей				
(5) Изготовители				(6) Применяемость в машинах			
(7) Запись	(8) Код предприятия и организации	(9) Объем производства	(10) Оптимальная стоимость	(11) Запись	(12) ВКГ ОКП	(13) Номенклатура чертежей	(14) Количество

Form 2

Key:

1. Product Code
2. Record
3. VKG OPK
4. Drawing Nomenclature
5. Manufacturers
6. Applicability in Machines
7. Record
8. Enterprise and Organization Code
9. Production Volume
10. Optimal Cost
11. Record
12. VKG OKP
13. Drawing Nomenclature
14. Quantity

The algorithm for the computation and selection of the gimbal drives is based on a method set forth in the Guide Technical Materials [RTM] 23.2.82-80 "Bases of the Computation and Design of Gimbal Drives of Agricultural Machines," contains approximately 1,000 commands and occupies 3 Kbytes of main memory. The computation program is written in the programming language FORTRAN IV, and 200 Kbytes of main memory is necessary for its operation.

The selection of the type size of the cardan shaft is made on the basis of the geometric and kinematic computations conducted. The output data are printed out with headings dependent upon the type of transmission. For example, VKM [expansion unknown]-1 Unionwide Classifier of Industrial and Agricultural Products [OKP] Code 47 91246449 or VKM-1-400-470 ANNA [expansion unknown] or OST 23.2.23-80 RTM-A 23.2.081-78.

The computation subprogram has the following output parameters:

distance between the centers of the joints, 470 mm;

distance from the center of the joint to the face of the hub of the end jaw, 120 mm;

joint rotation diameter, 125 mm;

pipe diameter, 60 mm and

pipe wall thickness, 4 mm.

Then, a longevity computation is made for specified parameters and the output data is printed out: longevity, 4,535 hours.

The results of the automated computations are used when matching the documentation for the use of gimbal drives. The use of gimbal drives that have been selected without preliminary computation of the parameters on a computer leads to a decrease in the reliability and the level of the unification of the drive devices and, in a number of cases, to an increase in the metal consumption and cost of the agricultural machines.

Thus, the information retrieval system on gimbal drives is capable of yielding information on queries for the denomination and code designation of concrete objects of a factorographic retrieval.

The IPS-gimbal program complex makes it possible to record source information into the memory of a YeS-1022 computer, store it and output it in the form of responses to standard inquiries. Besides producing responses to standard inquiries, the IPS on gimbal drives makes it possible to devise an entire series of derivative information retrieval and auxilliary arrays for implementing a retrospective retrieval.

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IMPROVEMENT OF AUTOMATION FOR PRODUCTION OF DESIGN DOCUMENTATION

Moscow STANDARTY I KACHESTVO in Russian No 9, Sep 85 pp 25-26

[Article by Yu. B. Fratkin and A. S. Tretyakov, candidate in the technical sciences, and K. V. Novikova and I. M. Yakubovich]

[Text] The automation of design operations is one of the basic resources for accelerating the development of new technology. However, the problems of the ways and methods of automating the production of design documentation [KD] has continued to be discussed up to the present. This is explained by the various approaches to its solution, which, to a certain degree, hinder the development of a unified view of the formation of requirements for KD prepared by an automated procedure.

Some people believe that design documentation that is developed with the aid of a computer should have its own requirements apart from those of the standards of the Unified System of Design Documentation [YeSKD]. At the same time, its production is made dependent upon the capabilities of peripheral devices and the complexity of the software. However, such a direction violates the purpose of KD, the manufacture of products and their use, i.e., to begin with, the KD will not satisfy the manufacturer or the users of the product. Others believe that design documentation that is developed with the aid of a computer may satisfy the requirements of the YeSKD standards. At the same time, the formulation of the question of the improvement of automation methods for producing KD is inseparably connected with the improvement, and not with fundamental changes, in the provisions of the YeSKD standards. The basic direction for improvement is not the simplification and stylization of design documentation, which allegedly must have a place in computer-aided design, but rather the creation of applications software that makes it possible to realize the concrete requirements of the rules and statements of the YeSKD standards, which have been developed with an allowance for production requirements and which have endured the test of time. At the same time, the effectiveness of using such programs is, to a large degree, determined by whether systematic principles, which permit the examination of the problem in its entirety with an allowance for a great variety of internal and external connections, have been laid as the basis of its development.

The use of a systems approach in the solution to the complex of programs in the automated production, calculation, storage and alteration of KD under conditions of the functioning of computer-aided design [CAD] is the sole correct path that yields the greatest effect. It makes it possible to create a universal system for the automated production of design documentation that provides the capability of automating the solution of an entire set of problems in their entirety in accordance with the requirements of the YeSKD standards. Such an integrated system ensures the objectivity of the propositions for the improvement of YeSKD and the validity of its structure.

At the same time, the correctness of the solutions obtained in the improvement of the YeSKD and the preservation of its stability can be ensured only with the observation of specified conditions:

1. The improvement of YeSKD standards must be accomplished both by specialists familiar with the YeSKD system and by specialists familiar with the bases of automation inasmuch as today YeSKD lies at the junction of two fields--design and automation.

2. During the development of KD with the aid of a computer, the statements of the YeSKD must be accepted as firm inasmuch as design documents are intended, above all, for the manufacture of products in accordance with them, independent of the kinds of procedures through which they were developed. Exceptions may be made only in those cases in which these provisions do not lend themselves to formalization or are ambiguous to understand.

In this case, the process of the development of programs for the automated production of KD must be, on the one hand, tied to the objective process of the improvement of the statements of the YeSKD and, on the other hand, must provide the identical execution of KD by computer-aided methods based on applications programs according to each type of design documentation.

Proceeding from a functional designation and modular design principle, the systems of the automated production of documentation includes the following subsystems:

preparation of diagrammatic documentation;
preparation of text documentation;
preparation of sketches;
automated introduction of changes, and
organization and management of a computer file.

Each of these subsystems represents a programmatically finite module consisting of a number of functional and service programs that provide the realization of assigned functions in accordance with algorithms for the operation of the subsystem. The information exchange between the various subsystems is organized through a general information base and within the subsystems themselves, through the internal information base (working, intermediate files). Unified linguistic rules of data formation are formulated and the composition of information and the structure and organization of the main information file of the system and the files of service information are determined for the information base.

The improvement of the system for the automated production of KD is connected with a keen understanding of the characteristic features of each type of document and the formalization of the acting requirements of the YeSKD. For example, circuit documentation occupies a significant place in the complex of design documentation for radioelectronic apparatus. Various types of electrical circuits, which are regulatable by the All-Union State Standard [GOST] 2.701-84, are a part of it. The standardization of graphic conventions and rules for circuit implementation permit a solution to the problem of synthesizing electrical circuit layouts using computer engineering.

The process of the automatic preparation of electrical circuits consists of the following basic steps:

description and input of the source information;
determination of the circuit format;
arrangement of the variable graphic symbols [UGO] in the circuit according to the sheets of the document;
arrangement of the UGO on the sheets of the document;
layout of connection lines between the UGO, and
output of the formed document on a graph plotter.

The input information for computer-aided preparation of circuits is the description of the components comprising the circuit and the description of the connection between the components. The information is input with the aid of special calculating devices or problem-oriented languages. As experience has shown, the second procedure is the more acceptable because it makes it possible to use a computer in the algorithmic synthesis of the graphics and to provide the greatest simplicity in the preparation of source data; at the same time, highly qualified specialists are not required to code the information.

The analysis of diagram documentation, which was done manually, made it possible to determine on the basis of statistical data the maximal amount of adjusting locations for the UGO of the components in circuits with various formats, which in turn made it possible to formulate and solve problems of the automated selection of the format and the arrangement of the UGO in the format selected.

The sequential approximation of the quality function, which contains a set of specified criteria for a close-to-optimal value, lies at the basis of the method for solving the problem of the arrangement of the UGO of the components in the working field of the format of the circuit. These criteria determine the ease of visualization of the diagram and include the following:

the evenness of the arrangement of the UGO of the components of the circuit on the working field of the format;

the minimal length of connections between the elements of the circuit;

the arrangement of the UGO of the components of the circuit in the direction of the passage of the signal, and

the minimal amount of breaks and intersections of conecting lines, etc.

As practice has shown, the usable arrangement methods provide a 70-75 percent ease of visualization of the circuits and makes it possible to arrange the UGO on the field of the circuit at a level that is sufficient for the usual understanding of the circuits that have been executed manually.

Up to the present, formal rules have still not generally been established for the execution of electrical circuits in analog engineering as opposed to circuits in digital engineering. During the automated production of such circuits, it is expedient to sue interactive graphics and to form an image of similar circuits in the mode of interaction of the developer with the computer.

The basic principle of developing packages of applications programs [PPP] for preparing text KD is the provision of the maximal possible level of automating all operations in the production of text documentation with the simultaneous reduction of the volume and the simplification of the preparation of the source data.

The provision of the maximal level of automation implies the development of PPP software that would permit the complete automation of the process of obtaining text documentation from the input of source data to the preparation of a document on a specified output device. The programs that have been developed up to the present time make it possible to ensure the automatic selection, from a source file of information, of the information that is necessary for the formation of the document; to form sections and subsections and headings and subheadings; to arrange records in sections and subsections with the requirements of YeSKD standards, to automatically form lines, sheets and documents as a whole; to fill a basic superstructure on the first and following sheets; and to prepare, when necessary, a sheet to record changes.

In addition, practice has shown that it is not always possible to provide for the automatic distribution of records in a document in the order established by concrete standards without the substantial complication of the input language in which the source information is described. Thus, GOST 2.108-68 demands a guarantee of the sequence of the information record in the sections "Standard Products," "Other Products" and "Materials" for specification in the ascending order of their basic technical parameters or type sizes of corresponding components. However, it is not possible to fulfill this requirement by means of programming with that structure of designation of the standard nominal values of electrical radio components (resistors, condensers, etc.) and type sizes and assortments of materials that have been established in TU [technical specifications] for purchased products and materials since the content and structure of the record of these parameters are not unified. In connection with this, it is expedient to develop in the very near future appropriate normative-technical documentation [NTD] that unambiguously determines the order for recording designations in the TU for purchased products and materials that would permit a substantial simplification of the development of design documentation not only by an automated but also by a manual procedure.

The use of packages of applications programs to obtain text design documentation reduces the labor-intensiveness of executing documentation to one-seventh or one-eighth in comparison with the normative labor-intensity during the manual procedure of preparation and will reduce the labor-intensiveness of obtaining diagram documentation to one-fifth or one-sixth.

The further improvement of automating the preparation of design documents includes both the processing of packages of applications programs that would guarantee the observance of YeSKD requirements and also the improvement and necessary formalization of YeSKD requirements. In the end result, the introduction of PPP substantially simplifies the operation of the designer and the implementation of normal inspection, leading finally to verification only of the quality of the graphic execution of the documents, which will be determined by the characteristics of the peripheral equipment.

The simultaneous process of the processing of the PPP and the improvement of the YeSKD should result in achieving a situation in which the PPP may be considered an extension to the corresponding YeSKD standards. Work in such a direction will make it possible to provide, in essence, unified requirements for design documentation independent of the means of obtaining it and will significantly weaken attempts toward the unjustified correction of the YeSKD standards.

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MODELLING OF DISINTEGRATION OF PESTICIDES IN ENVIRONMENTAL OBJECTS BY MEANS OF SELF-ORGANIZATION (REVIEW)

Kiev AVTOMATIKA in Russian No 4, Jul-Aug 85 (manuscript received 15 Oct 84) pp 12-21

[Article by Ye. I. Spynu, V. S. Kikot and V. V. Osipenko, Institute of Cybernetics imeni V. M. Glushkov, Academy of Sciences UkSSR, Kiev]

[Abstract] It is of economic importance to develop models for the toxic environmental effects of pesticides in a complex chemical/environment/man system involving a large number of interacting elements so as to establish the level and duration of pollution in terms of the pesticide content and the allowable dose for humans. Studies for a pesticide cost approximately 1 million dollars and last 3-6 years, which slows down the introduction of new types while problems arise because of differences between laboratory and field conditions, the large number of elements and difficulties in sampling and measurement. Because of the noisy character of the information input, the self-organization method is used for forming models involving selection of the essential factors and model optimization according to assembly criteria so as to recognize and identify factors and diagnose situations on the basis of limited sampling. Methods are based on pattern recognition and statistical decision theories and by means of a multiseries algorithm it is possible to approximate to a vector assembly of parameters which have an effect on the disintegration time of the pesticide. The vector can then be used to identify toxicity in fruits. A special problem is toxicity in soils. A multilevel algorithm was developed with a block structure for the input variable matrices so that the model is put together in several stages out of partial models relating only to certain parameters. This approach allows self-organization, minimal searching of models and easy synthesis of partial models. Prognosis of long-term pesticide disintegration times is by evaluation of a Markov process for assigned initial conditions because of the limited information available. Prognosis methods for establishing acceptable doses for humans now tend to be experimental. Figures 1; references: 21 Russian, 3 Ukrainian, 2 Western.
[448-12497/12947]

UDC 681.513

PREDICTION OF VECTOR PROCESSES BY MEANS OF SCALAR HARMONIC TRENDS

Kiev AVTOMATIKA in Russian No 4, Jul-Aug 85 (manuscript recieved 18 Apr 85) pp 34-39

[Article by V. I. Cheberkus, Institute of Cybernetics imeni V. M. Glushkov, Academy of Sciences UkSSSR, Kiev]

[Abstract] Multilevel modelling involves the use of languages with different levels of generality so as to raise the predictive effectiveness of the lower-level language to that of the high-level type and is used for self-organizing models predicting natural harmonic processes. It is shown that an expression for harmonic trends describing scalar processes can be used to predict vector processes. This can be done by means of a prediction balancing criterion for the scalar components of the vector which reflects the dynamic interaction of the variables. Theory of the procedure is described for the forecasting of river water quality represented by a vector formed of ingredient concentrations and its application for the forecasting of the essential variables of Lake Baikal ecosystem for the period 1960-2000 is given as an example. The method can also be used if measurements are made at several points rather than one so that an interrelated vector field is formed as on a river along which there are several quality control measurement stations. The prediction of variables characterizing the Kremenchug and Kakhovka dams for the period 1960-2000 is given as an example. Figures 2; references: 8 Russian. [448-12497/12947]

UDC 330.115

COMPARISON OF SEVERAL INTEGRATED DYNAMIC MACROECONOMIC MODELS

Kiev AVTOMATIKA in Russian No 4, Jul-Aug 85 (manuscript received 16 Jun 83) pp 47-53

[Article by V. V. Ivanov, Yu. P. Yatsenko, and U. Ye. Galiyev, Institute of Cybernetics imeni V. M. Glushkov, Academy of Sciences UkSSR, Kiev]

[Abstract] A comparison is made of three well-known self-organized models for dynamic representation of economic systems consisting of integrated links by Glushkov, Petrov-Pospelov and Kantorovich-Zhiyanov which differ as to their formulation. The Kantorovich-Zhiyanov and Petrov-Pospelov models describe a system consisting of a single undifferentiated production apparatus producing one product while additional productive capacity is introduced from outside and can be considered as a special case of the two-product Glushkov model. Conditions and expressions are given for the models. In all cases the macrostructures are based on analysis of the production structures but they are not identical. The models show the value of the output for a single time unit in terms of labor productivity or labor input and the number of work sites with certain conditions and are shown to be equivalent as concerns the formulation of output with a relation existing between the labor input of the technology and the time of application while wear and tear decreases productivity. An analysis shows that the ways in which productivity is formulated in the models are equivalent while the Glushkov two-product model describes a system in which one of the products consists of new work sites so that capital investment is from within while in the one-product systems capital investment comes from outside. The Kantorovich-Zhiyanov and Glushkov models differ from the Petrov-Pospelov model in that the work site characteristics are assigned according to the time of their creation so that information from previous years can be used, productivity and labor input functions are discontinuous and productivity can be considered a pulse transient function and integrated dynamic modelling techniques can be used. These aggregate macromodels can be used at various stages of planning in order to show general trends but multiproduct integrated models must be used for detailed analysis. Tables 1; references: 15 Russian. [448-12497/12947]

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DESIGNING SIMULATION SYSTEMS FOR SOLUTION OF BOUNDARY VALUE PROBLEMS USING ELEKTRONIKA K1-10 MICROCOMPUTER

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian No 5, Sep-Oct 85 (manuscript received 27 Sep 83, after revision 16 Apr 84) pp 49-52

[Article by I. F. Kabanets, A. Ye. Stepanov and A. I. Yatsunov]

[Abstract] The "Elektronika K1-10" microcomputer is used as the basis of a breadboarded modeling system for the solution of boundary value problems in mathematical physics using the 580IK80 microprocessor. The multiprocessor simulation system uses two kinds of microcomputers: 1) A central, and 2) a peripheral computer. The central microcomputer prepares, loads and executes the programs. It consists of a CPU, dynamic 48 Kbyte main memory, peripheral interfaces to GMD-70 floppy disks, an alphanumeric display and a printer. Two peripheral controllers run nine bidirectional buses for interfacing to the peripheral microcomputers. A peripheral microcomputer processes the data loaded into it by the central computer in accordance with the parallel execution algorithm. The relevant software is described using flow charts and the application of the system to the numerical solution of a second order partial differential equation is discussed. The iterative technique employed here using parallel processing is 6.98 times faster than a single processor system would be in this case. Figures 4; references 4: 2 Russian, 2 Western in Russian translation.
[32-8225/12947]

UDC 621.311.2

COMPUTER SIMULATION FOR SUBSTANTIATING RAPID DECISIONS IN FUEL AND ENERGY SUPPLY SYSTEM OF NATIONAL ECONOMY

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian No 5, Sep-Oct 85 (manuscript received 28 Sep 83, after revision 20 Mar 84) pp 83-89

[Article by V. I. Zhuravel]

[Abstract] The study of large-scale measures that can be implemented through the efforts of various sectors in the nation's fuel and energy complex over timeframes large as compared to generation and distribution cycles is best handled using mathematical simulation. Mathematical models are used for the evaluation of the current status of a controlled system, the determination of the consequences of disruptions in system operation and the definition of the primary indicators of prompt measures based on strategies developed by the controlling organizations. An overall model for the first stage of the nation's fuel and energy complex (TEK-1) is composed of three submodels: 1) The distribution of energy resources (organizational and territorial control); 2) Processing and transporting energy resources (process control); 3) Information support and feasibility analysis. This paper described the functions and interrelationships of the models within the TEK-1 system. The TEK-1 encompasses the following processes: product output at fuel and energy consumption levels that can be standardized, electric power and heat generation, oil refining as well as the producton of large-volume petroleum derivatives and coal reprocessing. Although the fuel and energy complex is not now an organizationally authorized sector of the national economy and is treated only as a unit whole in long range planning, this analysis shows that the direct and indirect links between its sectors necessitate prompt long range decision making at the intersectoral level. Figures 2; references: 9 Russian.
[32-8225/12947]

COMPUTERIZED SYSTEMS FOR DIAGNOSING CONDITION OF AIRCRAFT

Moscow VOZDUSHNYY TRANSPORT in Russian No 134, 7 Nov 85 p 3

[Article by V. Tseyukov, correspondent, Moscow]

[Excerpt] All essential information on the reliability of aviation technology is being gathered at a computer center. Associates of the State Scientific Research Institute of Civil Aviation's department for analysis of the reliability level of aircraft therefore visit this center frequently.

"A system for gathering, processing and analyzing information on various malfunctions of aircraft has been in existence for a long time, but another system, an automated one, is coming to take its place," related Genri Leonidovich Livshits, head of this department. "This system was developed jointly by scientists of our institute and colleagues from the Central Scientific Research Institute of Automated Control Systems for Civil Aviation. Practically the entire industry will have access to information on the reliability of aviation technology. Data will be 'memorized' and issued by computers not only at our institute's processing center, but also at diagnostic laboratories of aircraft repair bases. Magnetic tapes and disks will take the place of malfunction report cards. A single tape cassette will be able to hold more information than 60,000 cards.

"Unfortunately, the automated system 'Reliability of Aviation Technology' has been introduced only at certain airports as yet: at the Irkutsk, Krasnoyarsk, Yakutsk and Rostov-na-Donu airports and a number of others. The technical equipment available to the industry is largely unsatisfactory; in particular, there are not enough 'Iskra-226' minicomputers, which workers of reliability groups at our enterprises' aircraft repair bases are awaiting anxiously.

"Research in the field of evaluating the technical condition of aviation technology and diagnosing it is also being done at our institute. In collaboration with specialists of the Riga Institute of Civil Aviation Engineers, the Moscow Transport Administration and the Design and Experimental Bureau imeni Ilyushin, associates of our institute have developed a diagnostic system for determining the technical condition of IL-86 airplanes. This system is thus called 'Analiz-86'."

"What distinguishes the new system from existing methods of diagnosis?"

"The technical condition of an airliner's most important units, its engines, is analyzed in fairly large volume by the 'Analiz-86' system.

"In the second place, use of the 'Analiz-86' substantially shortens time for the testing of propulsion systems in technical maintenance. Engines are now checked only for air-tightness. The advantage here is obvious; after all, the less an engine is 'revved,' the longer its service life will be and the less fuel it consumes.

"The perfecting of the 'Analiz-86' system's program is continuing. It will soon be possible to evaluate the takeoff and landing characteristics of an aircraft and the condition of its electrical and air-conditioning systems and other things with the aid of this system. And the development of a subsystem called 'Ikipazh' (crew) will make it possible to oversee the piloting process: to detect pilots' mistakes and analyze emergency situations. The 'Analiz-86' system is already in service at Vnukovo Airport. The Sheremetyevo and Alma-Ata airports are next in line."

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RADIO INSTITUTE'S WORK ON AUTOMATION FOR DESIGNING, AVIATION

Leningrad LENINGRADSKAYA PRAVDA in Russian 5 Nov 85 p 2

[Article by S. Grachev]

[Abstract] The lengthy article reports on the development of automated equipment for designers, industry and aviation at the All-Union Scientific Research Institute of Radio Apparatus (VNIIRA). The institute's director is Gennadiy Nikolayevich Gromov.

The institute reportedly was one of the first to begin using computerized systems for designing products and equipping production facilities. Some of the institute's pioneer developers of computer-aided designing systems are saluted. It is recalled that Gennadiy Nikolayevich Orlovskiy, a USSR State Prize laurete, developed software and a coordinatograph for the first CAD system that was introduced in the institute's design bureau. Orlovskiy's collaborators on this project included T. I. Shafranova, now a senior project engineer; senior science associate A. M. Pokrovskiy; senior project engineer G. N. Novozhilov; and senior engineer V. I. Kirsanov.

The institute's more recent developments are said to include integrated complexes in which every stage of the development process, from scientific research and designing to the testing of experimental prototypes, is performed and monitored with the aid of computers. A computerized parts development system of this type was demonstrated for the author of the article in the institute's design bureau by Sergey Yevgenyevich Mokrinskiy, head of a sector.

Automated air-traffic control complexes of the "Start" series are among the institute's other developments. An improved complex, "Start-2", is now being tested at Pulkovo Airport. Microprocessor equipment has also been developed at VNIIRA for flight crews and aircraft maintenance. One unit allows maintenance operations on the IL-86 airplane to be performed by only two persons, it is claimed.

The institute's plans for the years ahead reportedly call for further expansion of comprehensive design automation. Work is planned, in particular, on the development of compact fifth-generation apparatus. Whereas lead time for developments has been shortened by one-third to one-half since 1980, the new fifth-generation equipment is expected to shorten it by as much as

three-fourths. The industrial introduction of new developments has been expedited by the formation of creative teams of a new type at VNIIRA. These teams include physicists, systems technicians, developers and industrial engineers, and they are said to be capable of carrying out every stage of a development and introduction process.

(A photograph is given showing traffic controllers working at the control console of the "Start-2" complex which is being tested at Pulkovo Airport.)

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TACTICS FOR MANEUVERING A MATERIALS-HANDLING ROBOT BY MEANS OF RANGEFINDER DATA

Kiev AVTOMATIKA in Russian No 4, Jul-Aug 85 (manuscript received 22 Mar 84) pp 40-43

[Article by A. D. Goltsev, Institute of Cybernetics imeni V. M. Glushkov, Academy of Sciences UkSSR, Kiev]

[Abstract] Materials-handling robots have to be able to avoid obstacles on the shop floor and visible light rangefinders are appropriate sensors. Algorithms were developed allowing the robot controller to process ranging information. Range data from the robot's field of vision is divided into small segments and is processed as to the robot's distance from a perceived obstacle through a comparison of ranging data for adjoining segments. An algorithm establishes a localization criterion incorporating 1) the angle between a sector and the goal expressing the directionality of the device; 2) the unimpeded distance from the goal expressing the perception of impediments; and 3) the angle to goal at the previous step which expresses the continuity of the device's movement towards the goal. This makes it possible for the device to find its way out of a dead end by moving around an open side or finding an outlet inside which was not visible to it on entry. However the algorithm is not eqippped to select gaps large enough for the device to pass through and to distinguish between possible and impossible paths. Therefore it is proposed to add to the robot controller a device for comparing openings between obstacles with the robot dimensions to determine whether the passage is possible and an additional term is added to the control algorithm expressing the condition. However the new algorithm has the drawback that even if there is no obstacle to a direct movement towards the goal the device still searches for a shorter path so that an additional mechanism must be introduced to check that the distance to the goal is decreasing which was not necessary with the simpler algorithm. The improved algorithm was experimentally tested on a laboratory model. Figures 5; references: 5 Russian, 2 Western.
[448-12497/12947]

WORK ON INTELLIGENT ROBOTS VIEWED AT SYMPOSIUM

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 10 Oct 85 p 4

[Text] Associates of Vilnyus University have developed a device equipped with a vision system which enables a robot to determine the speed of moving objects and to distinguish among objects surrounding it. This was reported at an All-Union symposium, "Vision of Organisms and Robots," which was held recently in the capital of Lithuania. Participants in this symposium discussed problems of the development of artificial-vision systems on the basis of the latest research in the fields of biology, psychology, and artificial intelligence.

"Soviet scientists are successfully using living prototypes in the development of such devices," said Doctor of Physical-Mathematical Sciences I. Kubilyus, president of Vilnyus University and chairman of the symposium's organizing committee. "Participants in the symposium were familiarized with the latest designs of robots of the 'arm--eye' type, and with manipulators that possess visual and sound receptors. Intelligent robots designed on the basis of natural models are becoming more and more capable of responding to external stimuli and transmitting their perceptions in the language of mathematical symbols. Such robots will find use primarily in such fields as machine building, power engineering, and the oil-extracting and electronics industries."

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MORE ON SYMPOSIUM ON ROBOT VISION, ARTIFICIAL INTELLIGENCE

Vilnius SOVETSKAYA LITVA in Russian 18 Oct 85 p 4

[Excerpt] As has been reported, an All-Union symposium, "Vision of Organisms and Robots," was held in Vilnyus. Eminent Soviet scientists who took part in this symposium discussed timely questions of the development of new-generation robots utilizing the latest achievements of biological science.

We invited participants in the symposium to share their thoughts on problems that were discussed.

Yevgeniy Sokolov, member of the USSR Academy of Pedagogical Sciences, head of a chair of instruction of Moscow State University: "The development of an artificial vision system is now possible thanks to comprehensive research of the mechanism of nervous activity of humans and living organisms. Problems involved in this were among the topics discussed at the symposium."

Aleksey Byzov, corresponding member of the USSR Academy of Sciences, head of a laboratory of the academy's Institute of Problems of Information Transmission: "Scientists of the biophysics and neurocybernetics laboratory of Vilnyus University are successfully using living models from nature. Work which these scientists have done on developing an artificial vision system represents an important step in equipping robots with elements of artificial intelligence."

Ionas Ketleris, head of the biophysics and neurocybernetics laboratory: "For 10 years, associates of our laboratory and specialists of the university's semiconductor-physics problem laboratory have been studying vision systems in their bionic aspect, for the purpose of applying research results to robotics. Results of theoretical and experimental research have made it possible to develop artificial organs of vision for robots. They are based on highly sensitive semiconductor matrices which resemble the retina of the human eye. Following the example of living organisms, these matrices recreate pictures of objects by processing information that they receive. Instruments have been developed which are capable of transmitting visual information to a computer."

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STUDIES OF SPEECH INTONATION AID VOICE-CONTROLLED ROBOT R&D

Leningrad LENINGRADSKAYA PRAVDA in Russian 17 Oct 85 p 4

[Article by S. Krayukhin]

[Excerpt] For the age of robotics, automatic devices controlled by the human voice are being developed. This task is still far from completion. The stumbling block here lies in the 'inanimate' electronic brains of robots, which are tuned to 'standard' speech signals and which perceive intonations of real human speech poorly.

I visited the bioacoustics laboratory of Sciences' Institute of Evolutionary Physiology imeni Sechenov. Acoustic principles of the language of emotions are now being thoroughly studied here.

The reels of a tape recorder were turning. The voice of USSR People's Artist Oleg Basilashvili was recorded on the tape. This eminent stage and screen actor was pronouncing only a single phrase, "If I may, I'll tell you the whole thing myself...," with pauses of a certain length between each repetition, but the meaning of the sentence seemed to be different each time it was spoken. This difference in perception resulted from the fact that the words were pronounced each time with a different intonation and different shades of emotion.

Professor V. P. Morozov, head of the laboratory, then showed graphs on which acoustic characteristics of the sentences spoken by O. Basilashvili were recorded. "Here, you see, Oleg Valeryanovich is speaking angrily; the sound is strong and snappish, and the curve rises sharply. In another case, the intonation is now plaintive; the sound rises and falls slowly, and the resulting curve is a flat one."

The laboratory's studies have demonstrated that each emotion has its own characteristic set of distinctive acoustic vocal signs. Each emotion is expressed by changes in all of the sound's properties: intensity, pitch, timbre, etc.

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USE OF COMPUTER FOR STUDYING THE MYSTERIOUS QUARKS

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 23 Oct 85 p 3

[Article from KazTAG]

[Text] The All-Union Conference-Seminar "Computational experiments in quantum field theory" in Alma-Ata on October 21 was devoted to opening up the use of computers in the theoretical physics of elementary particles. It was organized by the Scientific Council for Cybernetics of the Presidium of the USSR Academy of Sciences and the Kazakh State University imeni S. M. Kirov. Leading theoretical physicists, astrophysicists, and computer, hydrodynamics, and plasma-physics specialists from Moscow, Leningrad, and other scientific centers of the country were participants.

"Sixty years of the present century were marked by brilliant events in the physics of elementary particles," said Professor A. A. Migdal, the chairman of the organizing committee of the conference-seminar, to this KazTAG correspondent. "It was established that the known protons and neutrons, which comprise the basis of the atomic nucleus, were not the ultimate building-blocks of the universe, but they, in turn, were comprised of quarks. Their existence at present is not doubted by anyone and there is no single opinion concerning as to how they are constructed, because as yet, no one has observed quarks in the free state. They are associated with special kinds of forces. The interactions between quarks become weaker as they approach each other. But if one tries to "pull" them apart, then the forces begin to increase and the stress reaches thirty tons per particle! To separate quarks experimentally is not possible, not even in an accelerator that would encircle the whole planet."

To detect the mysterious quarks and obtain sources of tremendous amounts of energy latent in matter, scientists began to carry out computational experiments using computers to model the complex processes taking place in the world of sub-elementary particles. This scientific direction has attracted much attention in our country. And scientists at the Kazakh State University are participating in its development.

Conference participants are discussing theoretical ideas of the new scientific direction, outlining paths for its further development, and for concentrating the efforts of scientists in this area, and are exchanging experimental work on the quantitative descriptions of phenomena in the physics of elementary particles.

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COMPUTERIZATION DEMANDS ADVANCED MATHEMATICAL MODELING

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 5, 16 Jul-5 Aug 85 pp 1, 4-5

[Article by A. A. Samarskiy, academician, mathematician and physicist]

[Abstract] The author discusses at length the importance of advancing computer mathematics and mathematical modeling. He observes that there is a certain tendency to divorce questions of mathematical modeling from problems of the development of computer technology, with the result that the pace of development of computer mathematics is lagging behind that of computer technology.

Explaining how computers can help to solve extremely complex, large-scale scientific, economic and social problems, the author says that today computers for mass use are being developed, as well as specialized supercomputers with capacities of 100 million to 10 billion operations per second. The author contends that the approach to their development must be different from the approach that has been taken in the past. He explains:

"A computer system that serves scientists must reflect the specifics of the scientific investigation. The active principle must be: not to 'fit' the task to the machine, but the machine to the task. That is, adapt computers together with their software to definite classes of problems. Roughly speaking, it should proceed this way: given a problem or a mathematical model, construct a computer algorithm for it, compile a program on the basis of the algorithm, and then develop a computer that will execute the program."

The author goes on to discuss computer experiments, their methodology, and how they can help to solve problems in various fields of science and technology. He then assesses the state of mathematical modeling and its application, and discusses what needs to be done to improve it. Saying that computer mathematics and mathematical modeling must set the pace for development of computer technology, the author observes that too few mathematicians are doing applied work on computer technology. He says there is a need to create libraries of standard algorithms on a new methodological base, as well as packages of application programs for various classes of problems. There exists a fairly large number of packages of applied programs at the present time, but the author says they are not gaining wide use, due to a lack of information, lack of trust in someone else's results, and other reasons. He says development of computer programs is in the hands of a relatively few

specialists who are in effect determining the level and the effectiveness of all work on the use of computer technology, and he suggests that their expertise is mediocre at best.

Finally, addressing the question of what is holding back the use of computer experiments, the author says there is a shortage of mathematical models in many fields, and some groups of scientists underestimate computer experiments. Institutes that possess highly qualified specialists and good experience in computer applications often are poorly equipped. Where mathematical models are on hand, often not enough work is done on studying the properties of the object to be investigated and determining the parameters that must go into equations. The author calls for the creation of centers for calculating parameters of the object of study and its environment in the chemical, biological, physical and economic sciences. He also recommends the creation of mixed groups of physicists and mathematicians for carrying out R&D work based on computer experiments.

A photograph of Samarskiy is given.

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COMPUTER-AIDED EARTHQUAKE OBSERVATIONS IN FAR EAST

Moscow SOVETSKAYA ROSSIYA in Russian 20 Oct 85 p 6

[Article by Saktaganov, S. (Magadan)]

[Text] Observations of underground tremors and movements of the Earth's crust in the extreme northeastern part of the country will now be conducted with the aid of the latest electronic technology. Compact computers have been installed at facilities of the seismology team of the Northeast General Scientific Research Institute of the USSR Academy of Sciences' Far East Research Center. They will help the seismologists locate epicenters of earthquakes and determine their intensity quickly. Preparations are being made to introduce a bank of seismological data gathered from all over the region.

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OCEANOGRAPHY DATA BANK CAN PROCESS SATELLITE SIGNALS

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 9, 17 Sep-7 Oct 85 p 2

[Excerpt] A computer data bank "Oceanography: Pacific and Indian Oceans," has been put into operation at the Institute of Automation and Control Processes of the USSR Academy of Sciences' Far East Research Center.

The computer bank is not just a repository of all kinds of data on the temperature, salinity and chemical composition of the oceans. It is a complex program system, by means of which one can study the ocean in dynamic conditions and investigate the laws affecting it. In addition, the data bank makes it possible to plan the work of expeditions on ships of the scientific fleet.

Thus far, information obtained only by the method of 'contact' measurements is being stored in the new data bank, but it is also equipped for receiving and processing signals from Earth satellites. With the aid of data obtained from space, more accurate temperature maps of the water surface can be produced. This is very important for fishermen and mariners. On the Far East research ship "Akademik Korolev," trials of an on-line data bank are now under way, the purpose of which is to do primary processing of information directly during the voyage.

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SOCIALIST-BLOC SEMINAR ON COMPUTER AEROHYDROMECHANICS

Tashkent PRAVDA VOSTOKA in Russian 27 Oct 85 p 4

[Text] Samarkand--A seminar of member-countries of the Council for Mutual Economic Aid on the topic "Computer Aerohydromechanics" began its work here on October 25. Taking part in the seminar are scientists of Bulgaria, the German Democratic Republic, Poland, the Soviet Union and Czechoslovakia.

It was noted at the seminar that the solution of problems of aerohydromechanics involves a large volume of calculations and the use of computers. Questions of improving research in this field are receiving principal attention. Results of such research are important for the calculation of dynamic characteristics of airplanes and seagoing vessels, for the development of new machinery, including cotton pickers, and for the solution of many other problems.

Academician O. M. Belotserkovskiy, president of the Moscow Physical-Technical Institute, spoke at the opening of the seminar.

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NUMBERING SYSTEMS FOR COMPUTERS OF THE FUTURE

Moscow TEKHNIKA MOLODEZHI in Russian No 7, Jul 85 pp 40-43

[Article by Aleksey Petrovich Stakhov, professor, doctor of technical sciences, Vinitsa: "Codes of the Golden Proportion or Numbering Systems for Computers of the Future"]

[Text] As is well-known, the informational and arithmetic basis of present-day computers is the binary numbering system. Its invention is attributed to the Chinese emperor Fo Gi, who lived in the fourth century B. C.

In European mathematics, the binary form of numeric representation was evidently first described by the thirteenth century Italian mathematician Leonardo of Pisa, known as Fibonacci. This son of a Pisan merchant received his education in Arab schools and was well-acquainted with algebra and the decimal numbering system (the achievements of Arab and Indian scientific thought), and in 1202 he wrote "The Book on Counting," which played a significant role in the development of mathematics in Western Europe. This book examines a number of new combinatorial problems, the most famous of which is called "on the multiplication of rabbits." In solving this problem, the author discovers a mathematical sequence known as the Fibonacci series: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55....

It is easy to see that each subsequent member of this series, starting with the third one, is equal to the sum of the two preceding members. If we denote the n-th member as $\phi(n)$, then its relationship to the preceding members $\phi(n-1)$ and $\phi(n-2)$ is expressed by the formula:

$$\phi(n)=\phi(n-1)+\phi(n-2).$$

Similar relationships, called "recursive" (from the Latin "recurro," "to return"), have become a powerful tool in the solution of combinatorial problems.

Now we will form a series of numbers consisting of relationships between adjacent Fibonacci numbers: 1/1, 2/1, 3/2, 5/3, 8/5, 13/8.... It is easy to show that the boundary of this sequence coincides with the well-known number $\frac{1+\sqrt{5}}{2}$, that specifies the so-called golden proportion, otherwise known as the golden section.

Was the noteworthy mathematical fact of the relationship between the Fibonacci numbers and the golden section known to the numbers' author? His works do not yield any mention of this.

What made Fibonacci study the binary numbering system? Analysis of "The Book on Counting" shows that the actual numbering system interested him only slightly. The practical needs of commerce are another matter: what is the smallest number of balance weights needed to weigh merchandise? Fibonacci proves that the optimal system of weights is the following: 1, 2, 4, 8, 16... (which we will also call "binary" and will label with quotation marks).

The process of weighing should be started with the heaviest balance weight that we have (of course, we are not examining the case where an experienced merchant "questimates" the weight of the merchandise, and later refines his estimate by using the weights). This is what follows. If a balance weight is heavier than the load being weighed (that is, the balance weights, which may assume the status of Ø or 1, turn out to assume the status of Ø), then the balance weight must be replaced with another that is the closest in weight. If it is lighter (status of 1), then keep it and add the next one. This procedure continues until the smallest balance weight will have been utilized. The result is that merchandise weighing, let us say, 13 kilograms can be balanced with the following set of "binary" balance weights: 16 kg--Ø; 8 kg--1; 4 kg--1; 2 kg--Ø; 1 kg--1. If we will agree to always enumerate the result in this order (first, the heaviest balance weights, and then the lighter ones), then the weight of the load can be expressed in binary code: Ø11Ø1.

Let us return to the problem of the golden section of a segment, known from school-days as the extreme and mean ratio problem (its solution is shown on the back cover) [not reproduced]. The properties of the golden section, described by the equation $x^2-x-1=Ø$, equal to

$$\frac{1+\sqrt{5}}{2} = a,$$

have created a romantic aura around this number, as well as an almost mystical reverence.

The golden section was a sort of Pythagorean pearl of wisdom concerning the world's numeric harmony. Later, the principles of the golden section formed the basis of the compositional structure of many works of art, beginning with the architecture of antiquity.

The ancient Greek culture developed under the aegis of the golden proportion. The Greeks were the first to discover that the proportions of a well-developed human body adhere to its laws, which is well evident from the example of ancient statues (the Belvedere Apollo, the Venus di Milo). The Phrygian tombs and ancient Parthenon, the theater of Dionysius in Athens are all embued with the harmony of the golden proportion.

During the Renaissance, the golden proportion was elevated to the status of the primary aesthetic principle. Leonardo da Vinci, Raphael, Michelangelo, Titian and other great artists of the Renaissance consciously used the golden section in composing their canvases. The fifteenth century Dutch composer Jacob Obrecht widely used the golden section in his musical compositions, which to this very day are likened unto "a cathedral created by a brilliant architect."

In the nineteenth century, not only artists, but also scientific experimenters, having studied the natural order of phillotaksis (flower arrangement) again turned to the golden proportion. It turns out that the flowers and seeds of the sunflower, camomile, the scales in the fruit of the pineapple, pine cones and others are "packed" according to logarithmic spirals winding toward one another. In so doing, the numbers of the "right" and "left" spirals always are related to one another in the same way as the adjacent numbers of Fibonacci (13:8, 21:13, 34:21, 55:34). So this relationship, in its limits, gives us the golden proportion!

In our era, interest in Fibonacci numbers and the golden section has arisen with renewed strength. A number of musicological works emphasize the presence of the golden section in the compositions of Bach, Chopin, and Beethoven. Sergey Eysenshteyn used the golden section in editing scenes of his movies. Academic G. V. Tsereteli finds that the poetic harmony in the poem of Shota Rustaveli "The Knight in a Tiger's Skin" adheres to the golden section*....

Along with applied research, scholars continue to actively develop the theory of Fibonacci numbers and the golden section. The Soviet mathematician Yu. Matiyasevich solves the tenth problem of Gilbert by using Fibonacci numbers. Elegant methods are found for solving a number of cybernetics problems (the theories of retrieval, games, programming) by using Fibonacci numbers and the golden section. The Fibonacci Association of Mathematics has even been founded in the USA, which has published a special journal since 1963.

One of the latest achievements in this area is the discovery of generalized Fibonacci numbers and generalized golden sections.

The Fibonacci series (1, 1, 2, 3, 5, 8) and the binary series of balance weights discovered by him (1, 2, 4, 8, 16...) are completely different at first glance.

However, the algorithms for constructing them are quite similar: in the first case, each number is the sum of the preceding number and itself (2=1+1;

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* In studying the work's structure, the scholar decided to "arithmetize" it, that is, replace each word with a number equal to the number of syllables in the word. This resulted in a translation of the poem into a numerical language. Analyzing this translation involving all 6348 octometered lines, he discovered the golden section, as characterized by the numbers 3, 5 and 8 in these elegant and ringing lines.

4=2+2...); in the second case, it is the sum of the two preceding numbers (2=1+1, 3=2+1, 5=3+2...). Shouldn't it be possible to find a common mathematical formula to produce both the "binary" series and the Fibonacci series? Perhaps this formula would give us new numerical sets possessing new and unique properties?

As a matter of fact, let us take the numerical parameter S, which may take any value: Ø, 1, 2, 3, 4, 5.... Let us examine a numerical series, the S+1 first members of which are ones, and each of the next are equal to the sum of two members, the preceding one and a member S steps removed from the preceding one. Now, if the n-th member of this series is designated as $Ø_S(n)$, then we derive the desired general formula

$$Ø_S(n)=Ø_S(n-1)+Ø_S(n-S-1).$$

It is evident that, if S=Ø in this formula, we will derive a "binary" series; if S=1, a Fibonacci series; if S=2, 3, 4..., new series of numbers, which have received the designation Fibonacci S numbers.

The mathematician I. V. Vitenko (from Kharkov) and I came upon these S numbers in 1964, when we worked on the problem described by Fibonacci concerning the best system of weights, but in a more general case: taking into consideration the so-called "principle of the asymmetry of measurement."

What are the generalized golden sections, also called the golden S sections? Let us again turn to the figures on the back cover. Section AB is divided by point C in such a way that

$$\left(\frac{AB}{CB}\right)^S = \frac{CB}{AC}.$$

Thus, the golden S proportion is the positive root of the equation of the golden S section: $X^{S+1}-X^S-1=Ø$

It is easy to show that, if S=Ø, the section is divided in half, and if S=1, then we have the familiar classical golden section!

We have already established the mathematical relationship between the golden section and the Fibonacci numbers. Could it be possible that something similar exists between Fibonacci S numbers and golden S sections? As a matter of fact, the relationship of the adjacent S numbers of Fibonacci φ_S correspond with absolute mathematical exactness, within bounds, with the golden S proportions! In this kind of case, mathematicians say that the golden S section is the numerical invariant of the Fibonacci S numbers.

In this case, there is a legitimate question: are there any numbers φ_S similar to the way it was with, let's say, the number φ=1,618 in any natural phenomena?

Professor A. Sokolov, scientific leader of the bionics laboratory of the Moscow Order of Lenin Energy Institute, in his article "Secrets of the Golden Section" (see "Tekhnika molodezhi," No 5, 1978), sets forth an interesting hypothesis on the existence of certain numerical invariants that characterize waves of electrical activity in the brain. As a matter of fact, physiologists studying rhythms of the brain have found that the invariant of the cerebral beta wave is equal to 1,618. Invariants of other well-known waves (delta, theta, alpha, and gamma), computed from the values of their boundary frequencies and from the golden section equation (applied to the given phenomenon), are equal to 1,221; 1,324; 1,272 and 1,272. Experiments have proven that the alpha and gamma wave invariants are identical. Subsequent mathematical research on all the known waves of electrical activity in the brain has made it possible to establish a system of algorithms that forecasts the existence of waves with invariants of 1,464 and 1,380.

The invariants of brain waves with the values of 1,618, 1,464, 1,380, and 1,324 are none other than the golden S sections corresponding to the values S=1, 2, 3, 4!

The Belorussian philosopher E. M. Soroko, in his book "The Structural Harmony of Systems" (Minsk, "Nauka i tekhnika," 1984) presents even more surprising facts confirming the existence of S sections in nature. It turns out that, for example, the well-known double alloy possesses special, clearly recognizable functional properties (stable in a thermal sense, hard, wear-resistant, resistant to oxidation and others) only when the density of the original components is related by means of one of the golden S proportions. This enabled the author to propose a bold hypothesis: golden S sections are numerical invariants not only of the brain, but also of any self-organizing system. Having been experimentally proven, this hypothesis (the law of the harmony of systems) may be of fundamental importance for the development of synergetics, a new area of science that studies processes in self-organizing systems.

Let us look again at the weighing procedure described by Fibonacci. This time we will select the balance weights in accordance with a Fibonacci S series, not a "binary" series. It is obvious that the result of weighing can be recorded in this way: either there is or isn't a balance of a certain weight. Since the weight of the load is expressed as a number, we have arrived at a new way of binary representation of any number. This is the Fibonacci S codes.

Let us suppose that, in weighing a 15 kilogram load with the "Fibonacci" balance weights, it is possible to use this set of weights: 13 kg--1; 8 kg--Ø; 5 kg--Ø; 3 kg--Ø; 2 kg--1; 1 kg--Ø; 1 kg--Ø. Or this one: 8 kg--1; 5 kg--1; 3 kg--Ø; 2 kg--1; 1 kg--Ø; 1 kg--Ø. In Fibonacci code, this is recorded as follows: 1ØØØ1ØØ or 11Ø1ØØ. This ability to have more than one value is the basic property of the Fibonacci S codes.

If S>Ø, then they are redundant, since each such number corresponds to a set of code combinations, all of the elements of which may be derived by means of the so-called "convolution" and "involution" operations, represented as a Ø

or a 1 in Fibonacci code. Without going into the mathematical details of this process here, we should note that the monetary systems of many countries use it. For example, the basic series of coins used in the USSR corresponds to a Fibonacci series: 1,2,3..., and their change (5=3+2, 3=2+1, 2=1+1) corresponds to the "convolution" and "involution" operations in Fibonacci code. To emphasize, just as in making change the sum of available money remains the same, so the coded number does not change when "convoluting" and "involuting" binary digits.

What kind of practical value does this property of the Fibonacci S codes have? Let us perform all the possible "convolution" operations. The result is a code combination with an amazing property: there are no two adjacent ones! And if you perform all possible "involution" operations? Correct: you will never find two adjacent zeros. This amazing mathematical property portends a powerful means of testing and locating errors in future computational structures that use the Fibonacci code. This is because the task of creating error-resistant computational systems is dependent, above all else, on finding errors, which is made possible by the Fibonacci codes and golden proportion, in that they are a sort of natural generalization of the classic binary means of coding numbers. They both only share a way of positional numbering of real numbers, and, if S=Ø, the golden S proportion code amounts to the classic binary code.

The further development of this method involved codes of the golden S proportion. With their help, it is possible to express any real number as the sum of the golden S proportion steps with binary coefficients of Ø or 1.

A fundamental difference in this new way of coding numbers lies in the fact that the basis of the new codes, representing golden S proportions, when S>Ø, turn out to be irrational numbers. In this way, new systems of numbering with an irrational basis in a sense turn the historically conceived hierarchy of relationships between rational and irrational numbers "upside down." In actuality, natural numbers were "discovered" first, and then their relationships, which are rational numbers. Only later, after the discovery by the Pythagoreans of incommensurable segments, did there appear irrational numbers. We can say that in the decimal, quinary, binary and other classic numbering systems, natural numbers (10, 5, 2) were chosen as first principles, from which, according to certain rules, all other natural as well as rational and irrational (within limits) numbers were taken.

A new, irrational system is emerging as a sort of alternative to already existing ways of numbering, a fundamental principle whose basis of numbering is the irrational number (let us remember that its root is the equation of the golden section); other real numbers can be expressed through it.

This is how the number 5, for example, looks in the form of the finite sum of irrational numbers:

$$5=\left(\frac{1+\sqrt{5}}{2}\right)^{3}+\left(\frac{1+\sqrt{5}}{2}\right)^{-1}+\left(\frac{1+\sqrt{5}}{2}\right)^{-4}$$

Once again let us emphasize that any natural number is always representable in the form of a finite (not an infinite, as was previously thought!) sum of the steps of any of the golden S proportions. This is one of the reasons why "irrational" arithmetic, with its amazing mathematical simplicity and elegance, in a sense absorbed the best qualities of classic binary and "Fibonacci" arithmetic. That is why it holds enormous practical significance as a numbering system for future computers.*

Today, no one doubts that one of the primary ways of solving the most important problem for the latest computers, the problem of reliability, is redundancy. The introduction of redundancy by means of the Fibonacci codes and the golden proportion is inarguably superior in comparison with other mehods used at the present time.

In the first place, irrationally based numbering systems are a natural generalization of the classic binary numbering system, which they encompass as a special case. They preserve one of the most important achievements of mathematical sciences from the past, a positional numbering orientation, which means all the advantages of classic binary numbering: simplicity of arithmetic operations, "clearness" of code, the ability to shift code and numerical representation with a "floating" decimal, and others.

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* A curious detail, once again confirming that the most important and useful ideas are all around us. When A. P. Stakhov, at the start of 1978, was preparing his article "The Golden Proportion in Digital Technology" for the branch journal "Avtomatika i vychislitelnaya tekhnika" (published in No 1, 1980, with his first version submitted to the publisher 4 July 1978), in which he first formulated his ideas on using numbering systems with irrational bases in computational technology, he did not yet know that in the very same year, 1978, the publishing house "Mir" would publish the third volume of the famous American programming specialist Donald Knuth's monograph "The Art of Programming." When he read that work, he was surprised to find that Knuth widely used the Fibonacci method and the golden section to solve programming problems. In the same work was a reference to an article by the American scientist George Berman entitled "An Irrationally Based Numbering System," published in 1957, in which was described a special but very important case based on the classic golden proportion. Although Stakhov described a more general class of system, nevertheless the original discovery of "irrational numbering systems" belongs to George Berman, and in a later version of his article, he referred to Berman's work. It is typical that engineers simply did not notice Berman's article. It was published in a special mathematics journal, and its author had even written: "I do not know of even one practical use for these kinds of systems, except for the mental exercise and to pass the time, although they may be useful for the theory of numbers."

Secondly, because of extensive redundancy, it is possible to create a unified system of complete control over the entire (without exception) numerical apparatus and in the future create error--resistant computers and other digital equipment.

The redundancy of these numbering systems is already used to solve other problems of digital technology, specifically to improve the density and reliability of digital magnetic reading and recording, as well as to increase the capacity and reliability of information storage in bubble memory devices. At the Vinnitsa Polytechnical Institute, a 17-bit converter has been created that operates on Fibonacci codes: highly accurate, metrologically stable and high-speed. There is every reason to believe that these qualities will be present in full measure for other analog-digital and digital-analog converters that use this new principle in their design.

Finally, we should note that classic binary arithmetic, now used in computer technology, has fundamental weaknesses: it is impossible, for example, to perform arithmetic operations sequentially from the highest-order to the lowest-order digit, as this sharply lowers the computer's performance. Computers that will operate with irrational numbering systems will not have these "minuses," since in so-called sequential (digit-by-digit) arithmetic, mathematical operations can be performed, starting from the high-order digits.

It would not be out of place for the new high-performance arithmetic and its accompanying arithmetic units in a new generation of computers to be used in multiprocessor computing systems with programmable architecture (A. V. Kalyaev).

These results will undoubtedly contribute to a crucial turning point in the thinking of computer designers from the traditional numbering systems to the Fibonacci codes and golden proportion, numbering systems for computers of the future.

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ELECTRONIC FANTASY GAMES FOR THE 'ELEKTRONIKA BZ-34'

Moscow TEKHNIKA MOLODEZHI in Russian No 7, Jul 85 pp 56-57

[Article by Yu. N. Glazkov, department consultant, Hero of the Soviet Union, aviator-cosmonaut of the USSR: "Soft Landing! New Electronic Fantasy Game for the Personal Computer Class 'Elektronika BZ-34'"]

[Text] We direct your attention to a modification of the game described in the June issue of "Tekhnika molodezi." Controlling its vertical thrust, the player has to land his space ship, moving at a low, constant horizontal speed, at a selected point on the surface of a planet (see drawing).

The program "Lunolet-1," published in the previous edition, is used for the game. Preparatory operations and source data input remain the same. The only difference is that the initial distance (on the horizontal) to the landing point in meters has to be loaded into register S, and the horizontal speed in meters per second has to be loaded into register O. These operations are implemented by the commands: (distance m) PS (speed, m/s) PO.

The game is played exactly as in the already published version, but in analyzing the situation, it is helpful to check the current distance to the landing point by using the command IPS. The skills obtained in working out the landing with a constant horizontal speed will come in handy later, when we solve much more complicated navigational problems. Soft landing!

Make Your Own Planet

One of the most important constants used in our game is the free fall acceleration on the planet's surface. Two more parameters that you will soon need are the planet's radius and circular velocity. We have included a summary table of these values for those heavenly bodies (excluding the giant planets) for which they are known more or less accurately.

Any other reliable data for other heavenly bodies are unavailable. On the other hand, planetologists have established a rather simple relationship between free fall acceleration and a planet's radius, if the planet is composed of materials similar to the earth's. We will illustrate this in the form of a program for the "Elektronika BZ-34" PC:

00.PO 01.IPV 02. + 03.PD 04.1 05.- 06.IPC 07.x 08.Fe^x 09.IPD 10.x 11.IPA
12.x 13..^ 14.IPO 15.x 16.1 17.VP 18.3 19.x 20.F$\sqrt{}$21.$\overrightarrow{XY}$ 22.C/P 23.BP 24.00

This program is called "Planet Designer" (abbreviated "PK-1"). In order to run the program, you must first, after loading it, enter in register A the free fall acceleration of the earth's surface (in meters per second squared), enter in register B the average radius of the earth (in kilometers) and in register C the empirical dimensionless constant equal to 0.6904. These operations are carried out with the commands: 9,81 PA 6371 PB 0.6904 PC V/O. After this, you can begin to design your own worlds. Specify the radius of the planet that you want to create, type in its size in kilometers, and press S/P. After pausing, the display will show the free fall acceleration on the surface of your "ready-made" planet, and the circular velocity is located in register Y (it is called to the screen by the command $\overleftarrow{XY}$). Now you can set up the radius of the next planet and again press S/P. Experience shows that it's as easy as pie to make planets this way.

If you want to try the "PK-1" program using our table, an interesting detail will emerge. The computed values are almost the same as the experimental values for the earth, Venus, Mars, the moon, Io and Europa. On the other hand, the calculated values for free fall acceleration on Ganymede or Callisto are almost two times the actual values. This means that these heavenly bodies, in a strict sense, do not belong to the earth's group: they are composed of materials two times less dense, on the average, than the earth's rock. It is on the basis of this comparison that scientists came to the conclusion that these two satellites of Jupiter consist of approximately one-half ice. The same can be said for the majority of Saturn's satellites. However, Mercury, as can be easily shown to the contrary, is made up of denser rock: the computed value of gravity on its surface is one and one-half times less than the experimental value. It is thought that the abnormally high density of Mercury is connected with its proximity to the sun: under the influence of radiation, the lighter elements left the planet, probably during the process of its formation.

Guess the Gravitational Pull!

Now that you can design your own planets with any kind of gravity, you can play another game based on the "Lunolet-1" program. Two people play this game. After loading the PC with the program and set of source data, one of the players (without the other person's knowledge, of course) loads into register 4 the free fall acceleration on the surface of the planet which he has selected at random (the planet may be an actual one or one produced by "Planet Designer"). Initial speed and flight altitude are specified as 0, and the amount of available fuel is sufficient for takeoff, a short flight, and landing. The second player has to determine the free fall acceleration without looking into register 4. This should be done in the following way: 1) take off from the planet's surface and climb to a low altitude; 2) adjusting thrust, assume a position so that the craft hovers in one place, for all practical purposes, just above the surface; 3) at the next pause, call to the screen, by means of the IPZ command, the propulsion value of the craft's engine. Since the craft is stationary, this value corresponds to the free fall

acceleration. Of course, you probably won't be able to hang completely stationary; it follows that you will ascertain an approximate force of gravity. Having determined the acceleration, the player has to then make a soft landing; otherwise, the result does not count. After the landing, the amount of available fuel is restored, and the players change roles. The winner is the player that guesses the most correct decimal places of the opponent's intended value.

Turning off the engine, even for a short time, is not allowed in this game; if this were possible, the free fall acceleration would be easy to calculate by dividing the difference in the speeds by a segment of the free fall for its duration.

The electronic fantasy game "Guess the Gravitational Pull" is remarkably useful for developing piloting skills, without which there would soon be nothing to do in our club.

Scenario Generator

As you may remember, the first meeting of our club was held, in a manner of speaking, at the KLF. A month later, there was a return visit; our colleagues at the KLF dropped by the place set aside for us. They didn't just come by to drink some tea; they brought a table (see page 58) that makes it possible, running your finger along the arrows provided, to rather simply generate scenarios of fantasy stories in a practically unlimited (it could almost be said, fantastic) quantities. This table (it's called the "Pocket Computer for the Neophyte Fantasy Writer") was taken from a monograph by Stanislaw Lem entitled "Fantasy and Futurology"; the purpose of their visit was formulated in these words: "What kind of computer makes you look things up with your fingers? Help!". We understood that they desperately needed a progrram that would free them from the rather tiring process of fingering the table, while producing a ready-made scenario. Here is the program that we happily gave them.

00. Fx=0 01. 05 02. PZ 03. BP 04. 55 05. Fx(0 06. 11 07. F$\sqrt{\ }$ 08. KNOP 09. BP 10. 00 11. P2 12. PO 13. 1 14. P1 15. 3 16. Fcos 17. Fx(0 18. 58 19. IPZ 20. 1 21. BP 22. 8 23. - 24. Fx$\geq$ 25. 32 26. IP1 27. F10^x 28. IPZ 29. X 30. BP 31. 53 32. IPZ 33. 1 34. BP 35. 7 36. - 37. Fx$\geq$0 38. 47 39. IP1 40. 1 42. X 43. 7 44. - 45. BP 46. 27 47. IPZ 48. 1 49. 0 50. X 51. IP1 52. + 53. PZ 54. IP1 55. S/P 56. BP 57. 00 58. IP1 59. 1 60. + 61. P1 62. FL0 63. 15 64. IP2 65. BP 66. 12

This program (it's called "The Electronic Fortune Teller") should be used in the following manner. After loading the program, switch to the computing mode and press V/O. Then, set the switch R-G to G ("guess"), chose 0 (this is the signal that we are starting to develop a new scenario), a press S/P. In a few seconds, 0 should appear on the screen; the computer is ready. Take Lem's diagram; the zero position corresponds to the rectangle in which is written "Earth." Four arrows point away from the rectangle, four possible moves in the scenario ("Burns up, or freezes, or falls to the sun," "Scientists," "Invaded," "Collides with a gigantic comet"). Enter the number

of options: 4 S/P. Numbers flash across the screen: the electronic writer is feverishly deliberating which option to choose. Let's open the door to the cybernetic "kitchen." The "Elektronika" is scanning the numbers from 1 to 4 (1, 2, 3, 4, 1, 2, 3, 4, etc.), and in so doing, several seconds pass on each number. While the R-G switch is set to G ("guess"), the selection process will take an unlimited amount of time. This is not what we want, of course; having waited a minute or two, we switch to R ("result"). The electronic meditations cease, and an option number, selected by "Elektronika" with our help, appears on the screen (let's say, the number 4). Therefore, we took the branch "Earth collides with a gigantic comet." We are now faced with a new branch and three possible options: "And blows up (the end)," "But remains unscathed (the end)," "And doesn't blow up, but." We set the R-G switch to G and press 3 S/P. Our cyberneticist-fantasy writer again enters a state of tiresome meditation. As before, after a time we help him: we switch to R. The "Elektronika" issues the next scenario move number; now we have to switch to G and give the computer the parameters of the branching point in the diagram. Acting in this way, we soon reach the word "end." This means that the scenario of the first work is ready. We press XY on the keyboard. The screen shows a sequence of numbers. This is the code to the plot that we generated. The first digit is the option number for the first branching point, and so forth. With the understanding that the branches are enumerated from left to right and top to bottom, the code 432, for example, translated from machine language to Russian means: "Earth collides with a gigantic comet and does not blow up, but almost everyone dies (the end)."

The development of a new scenario starts with the command 0 S/P. If, in the course of operations, you choose a negative option number, the "Elektronika" politely informs you that you have made an error: the screen shows the word EGGOG. In that case, enter the right number: the quality of the scenario will not be influenced by your error.

(1) Название небесного тела	(2) Радиус, км	(3) Ускорение силы тяжести, м/с²	(4) Первая космическая скорость, м/с
Планеты (5)			
Земля (6)	6371	9,81	7905
Венера	6056	8,85	7321
Марс	3394	3,72	3553
Меркурий	2440	3,70	3005
Плутон	1500	0,4	780
Спутники Юпитера (7)			
Ио	1815	1,80	1807
Европа (8)	1569	1,32	1437
Ганимед	2631	1,43	1943
Каллисто	2400	1,23	1715
Спутники Сатурна (9)			
Мимас	196	0,06	102
Энцелад (10)	250	0,08	143
Тефия	530	0,15	283
Диона	560	0,22	351
Рея	765	0,26	447
Титан	2575	1,37	1881
Япет	730	0,14	317
Луна, Тритон (спутник Нептуна), Харон (спутник Плутона) и Фобос (спутник Марса) (11)			
Луна	1738	1,62	1678
Тритон (12)	2100	2,0	2049
Харон	650	0,2	350
Фобос	11	0,007	9

Key:

1. Name of heavenly body
2. Radius in kilometers
3. Free fall acceleration, meters per second squared
4. Circular velocity, meters per second
5. Planets
6. Earth
   Venus
   Mars
   Mercury
   Pluto
7. Satellites of Jupiter
8. Io
   Europe
   Ganymede
   Callisto
9. Satellites of Saturn
10. Mimas
    Enceladus
    Tethys
    Dione
    Rhea
    Titan
    Japetus
11. Earth's moon. Triton (satellite of Neptune), Charon (satellite of Pluto), and Phobos (satellite of Mars)
12. Earth's moon
    Triton
    Charon
    Phobos

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UNIVERSAL COMPUTER EDUCATION PROPOSED FOR KAZAKHSTAN HIGH SCHOOLERS

Alma-Ata PARTIYNAYA ZHIZN KAZAKHSTANA in Russian No 10, Oct 85 pp 80-82

[Article by V. Sidorov, Kazakh SSR first deputy minister of education: "Universal Computer Education - The Imperative of the Times"]

[Text] The transition to the intensive development of economics and the rearming of the national economy presuppose the broad use of computer technology and microelectronics. At a CPSU Central Committee congress on accelerating scientific-technical progress, Comrade M. S. Gorbachev noted that the catalysts of contemporary scientific and technical progress are microelectronics, computer equipment, instrument-building, and the entire informatics industry. The introduction of the latest technology in all industrial sectors requires appropriately trained workers capable of managing complex systems and mechanisms. The training of such people must start right within the school walls. The Main Guidelines for Reforming General Education and Professional Schools indicate, in particular, the necessity for ensuring universal computer literacy among the young, and the need to cultivate among students skills in the use of modern computer technology. The course "The Fundamentals of Informatics and Computer Technology" has been taught in all the republic's secondary schools since September 1st, in accordance with the April (1984) CPSU Central Committee Plenum and the first session of the USSR Supreme Soviet's 11th convocation.

The course content is based on three fundamental concepts of modern science: data processing, the algorithm and the computer. We must formulate among students an understanding of the fundamental principles and methods of solving problems on computers and elementary skills in the use of microcomputers. We must also familiarize them with the prospects for computer technolgoy development. Moreover, informatics and computers are becoming the foundation for studying a number of natural science subjects on a qualitatively different level. The ability to apply electronic computer equipment in lessons may significantly raise the clarity of instruction. Computer models of complex objects and processes make the mastery of study materials more attainable and significantly reinforce the cognitive abilities of school children.

Acquiring computer literacy is a complicated, but achievable, matter. Three years ago, the USSR Ministry of Education recommended the use of microcalculators in the teaching process, beginning with the seventh grade. It also

recommended teaching school children the techniques of working with electronic computer equipment in mathematics, physics, and chemistry lessons. Our nation has almost 20 years of experience in teaching youths the use of computers and programming. The summer school for young programmers at the Siberian Section of the USSR Academy of Sciences has been in operation for almost ten years. Of interest is the work on experimental study of the principles of informatics and computer technology in the secondary schools of Moscow, Leningrad and Zelenogorsk. Specialists in scientific research institutes help school children master the principles of data processing.

Kazakhstan has also accomplished something toward the introduction of computers in the teaching process, in particular, in the republic's physics-mathematics boarding school, and in the secondary schools of Alma-Ata and Karaganda. Many production training centers teach school children to specialize as operators and programmers. Two institutions merit attention for their joint work on optimizing the teaching process through computers: the USSR Academy of Pedagogical Sciences General Pedagogy Institute and the Petropavlovsk Institute. The pedagogical institute created a laboratory for optimizing the teaching process. Its mission includes analyzing textbooks and the students' knowledge, creating mathematical models for an ideal textbook, and testing this model in practice, in base schools 1, 35 and 43 of the city of Petropavlovsk. For several years, the students of the Physics-Mathematics Department have participated in a night school for programming in the Siberian Section of the USSR Academy of Sciences.

The Kazakhstan Ministry of Education has developed primary measures for studying the course "The Fundamentals of Informatics and Computer Technology" in the republic's general education schools. The necessary changes have been made in curriculums of all kinds for the 1985-1986 school year. Due to the specifics of electronic computer technology, the course is conducted in the Russian language in nationality schools. All physics and mathematics teachers have undergone appropriate training in institutes of teaching improvement. School directors and assistant directors with physics and mathematics training have mastered the new course in departments of training and qualification improvement in the Kazakh, Kzyl-Orda, Pavlodar, Uralsk and Kustanay pedagogical institutes, and also in Karaganda State University. For the future, it has been decided to introduce mathematics and physics courses with an additional 120-hour specialty: "Informatics and Computer Technology."

There are many problems associated with the creation of an appropriate material-technical base. From 1985 to 1990, study centers for electronic computer and microprocessor technology will be created in all pedagogical institutions of higher learning, teaching improvement institutes, one or two schools in each rayon, schools with intensive mathematics instruction and intermural production training centers. It should be noted that the CPSU Central Committee and the USSR Council of Ministers have decided that all ministries, sub-departmental enterprises and institutions with electronic computer equipment must create teaching departments with displays for conducting classes with students. In the long run, each school msut have a computer technology study center.

The temporary lack of computer equipment does not prevent children from mastering the theoretical and cognitive part of a course on the principles of data processing and computer technology. Moreover, they can carry out computer practicums on programs compiled on microcalculators. Yet, difficulties may arise here as well. Unfortunately, the majority of recently inspected schools does not possess a full set of microcalculators, even though recommendations for their use were sent to the republic schools as early as 1982. This is now negatively affecting the computer skills of seventh and eighth graders. The teaching process and practical classes do not utilize methodological recommendations on the use of electronic computer equipment. A certain percentage of the pedagogues is not psychologically and methodologically prepared for work with new technology. Here too the social education organs must perform much work with teachers, in order that they see the great capabilities of microprocessors. It suffices to say that the microcalculator may ensure the fulfillment of all computational work encountered in school. They are irreplaceable in mathematics, physics and chemistry lessons in the upper grades, where they are used not only to simplify computational work, but also in place of mathematical tables, and to lead students toward one or another hypothesis, which is later proven.

The mastery of data processing and the development of universal computer education is a task of colossal proportions. Many problems arise: the preparation of the required number of computer technology study centers and the development of mass production of computers. The material expenditures may be imagined from the facts that over a million computers must be sent to the schools: no fewer than 50 thousand computer technology study centers must be created; and the most acceptable computers must be selected for our schools.

Much time is needed to solve all of these problems. Yet, a school cannot stand in place. In places where there are no computers, a minimum of computer literacy must be ensured in mathematics and physics lessons, in worker training classes, and in elective courses. Schools must use computer centers and laboratories, where, in turn, the doors must remain open for students. The difficulty of introducing the new course in the curriculum consists in the fact that the overwhelming majority of teachers of mathematics and physics entrusted with conducting this course will have to master it practically along with the school children. Here too it is very important to support the teacher, to help him surmount the barrier of novelty, and to help him psychologically adapt to new requirements. Party organizations and school administrations can accomplish much in this regard.

As in other reform trends, the matter of computerization of the schools requires truly nationwide support. The main thing is to aid in providing the required technology for the new course. Industry faces serious tasks in the production of computer equipment. So do the major enterprises and associations, in providing the schools they support with computer study centers; and the pedagogical VUZes in training graduates for work with microprocessors. The schools also await assistance from parents who are involved in computer technology due to their profession, i. e., engineers, performance testers, programmers and specialists in computer applications.

We also need broad propagandizing of the new school course in all mass media channels, in popular and instructional films, televised lessons and lessons on algorithmic literacy. The republic has experience in the introduction of computers, and it would be useful to make them accessible to all.

Great benefit would derive from developing extracurricular forms of work with students on mastering computer skills, the broad use of computer equipment in organizing students' technical creativity in intermural production training centers, and introducing all manner of clubs, pioneer clubs and school clubs into the work system. It is also time to conduct competitions for young technicians and naturalists and olympiads, using computer equipment.

The comprehensive and in-depth mastery by youths of electronic computer technology will serve as an effective foundation for the further development of scientific and technical progress. Already within the school walls it is important to form a person who is able to go in step with time, and to think and work in a new way. This task has already been subordinated to the efforts of party, Komsomol and trade union organizations of schools and supporting enterprises. The task posed by the Party--to ensure computer literacy among students and to train young men and women for active participation in the socio-economic development of the nation--may be successfully resolved only through the common efforts of pedagogical collectives and public opinion.

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THE DESIGNER AT THE DISPLAY TERMINAL

Moscow MOSKOVSKAYA PRAVDA in Russian 18 Oct 85 p 2

[Article by Professor Yu. Topcheyev, doctor of engineering sciences and chairman of the scientific and methodological council on automated design of the USSR Ministry of Higher and Secondary Specialized Education, Moscow Engineering and Physics Institute, subtitled, "Science and Technical Progress: Tasks of the Higher School."]

[Text] On the screen of a graphic display is a spatial image of a vehicle body being designed. It is achieved with the aid of special instructions gathered on the display. The machine is given a task, and on this same screen appear figures and symbols characterizing the parameters of the obtained model. Having changed them and giving other geometric dimensions to the vehicle body and having formed its individual elements, it is possible to obtain increasingly newer variants. The machine helps to compare them and to select the most optimal.

With traditional methods of designing, one had to draw several different variants by hand and the number of them would be limited; this by itself would not permit finding the best solution. And immeasurably more time would elapse in the search of the variant.

With the aid of up-to-date computers and terminals, which necessarily include alphanumeric and graphic displays, one can create systems for automated design, development, and technological preparation for production. With the use of this equipment, the process of designing can be successfully automated to a significant degree. As a result, the time for launching new items in serial production is shortened, and expenditures on materials are lowered, expenditures on energy and transportation are decreased, and engineering personnel are freed for use at plants and factories newly put into operation . . .

The solution of all the indicated problems can be accomplished only by highly qualified specialists of a new type who have mastered automated design methods. Their training has been entrusted to engineering VUZ's. The graduation of such specialists requires substantial change in the instruction process. At a number of Moscow VUZ's, particularly at Moscow Engineering and Physics Institute, Moscow Aviation Institute, Moscow Physics and Technology Institute, Moscow Chemical Technology Institute, Moscow Higher Technical School, Moscow Power Engineering Institute, Moscow Institute of Steel and Alloys, and Moscow Institute of Electronic Technology, they have for several years been preparing specialists who can develop automated design systems for leading branches of industry. But their quantity does not satisfy the requirements of the economy.

There are many reasons for the restrained expansion in the training of specialists. One of them is related to the organization of the instruction process. Special disciplines should be introduced into the curricula: discrete mathematics, the theoretical bases for structuring and creating automated design system software, data banks, information support, dialog systems and machine graphics, the theory of adopting planning and design solutions, and so forth.

But how can high quality preparation of specialists be ensured? The study process must be organized in such a way that student contact with computers is uninterrupted beginning with the first semester and ending with the diploma project design. Only under such conditions will it be possible to successfully train engineers who can accomplish design and theoretical development of manufactured items (or structures), create planning and design documentation and technological charts for preparing production on computers. Laboratory and practice sessions as well as the accomplishment of course and diploma projects should be conducted in display terminal classes on academic-research automated design systems.

In leading Moscow VUZ's, students take part in the scientific research of the automated design system department. As a result, their activity in the instruction process is greatly increased, and students receive practical experience. Incidentally, this is another argument in favor of increasing the volume of scientific research work in VUZ's, the necessity for which was discussed at a meeting of the CPSU Central Committee on problems in accelerating scientific and technical progress. So VUZ's must be equipped with up-to-date computers and especially terminals, without which it is not possible to create display terminal classes.

Here is found one of the basic things that interfere with the expansion in training specialists in automated design systems. At the present time, engineering VUZ's are fitted-out with obsolete automated work places with SM-3 or SM-4 processors possessing little main memory and completely unsuitable for training engineers and designers. It is necessary to have automated work places with type SM-1420 processors with a large main memory and a capability for further expansion. Automated work places should be fitted out with three-dimensional, three-color graphic displays with a high-resolution capability.

USSR Gosplan should assign funds for immediate delivery to VUZ's of the most up-to-date computer technology on which specialists will be prepared for industry, since the technical policy of all branches of the economy depends on their knowledge and ability to work. It is important in this regard to ensure the distribution not only of computer technology but also of the corresponding software.

The problem still requires solution, since the basic stock of computers of the unified series (YeS) that have been supplied to VUZ's, because of the small amount of main memory, cannot work with the new version of universal operating system. It turns out that for the organization of a dialog process "User- computer - Applications Program Packages," each VUZ creates its own specialized operating system. As a result, it is becoming impossible to have inter-VUZ exchange of software, for the creation of which a very large amount of labor has been expended by highly qualified programmers.

It seems to us that the USSR State Committee for Science and Technology must arrange the coordination of all work of specialized and programming support accomplished at

VUZ's and industrial organizations with the aim of unifying them. One cannot help drawing attention to the abundance of algorithmic and dialog languages in which software is composed in VUZ's and in industry, and this hinders the exchange of programs on magnetic storage units.

The majority of Moscow VUZ's still do not have department affiliates at enterprises, and this slows the organization of training of specialists in automated design systems directly for industries. Workers in industry are rarely attracted to the conduct of studies in VUZ's, and they do not pass on to students their experience in creating industrial automated planning and design systems. Such a position lowers the level of scientific research conducted at VUZ's, despite the fact that they have the largest number of programmers in our country.

With the aim of generalizing the experience of Moscow VUZ's in the area of training specialists in automated design systems, the USSR Ministry of Higher and Secondary Specialized Education has charged the Moscow Engineering and Physics Institute, together with the Moscow Aviation Institute, Moscow Chemical Technology Institute, Moscow Institute of Steel and Alloys, and Moscow Power Engineering Institute with attracting leading industrial specialists to conduct inter-VUZ seminars for the discussion of methods for introducing automated design systems into the academic process. The seminar was attended by over 250 participants from 50 engineering VUZ's of the country and 25 head enterprises of industrial ministries. The conference generated recommendations for raising the level of specialist training in the field of automated design systems and created a standard automated work place, the publication of textbooks, study aids, and methodological elaborations.

The successful accomplishment of all these recommendations requires the creation of complex national programs for increasing the number of graduating specialists and the development of scientific research in the field of automated design systems.

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ROLE OF ELECTRONIC GAMES IN NURTURING COMPUTER LITERACY EXAMINED

Moscow PRAVDA in Russian 8-9 Sep 85 p 3

[Article by M. Vasin]

[Abstract] The two-part article addresses the question of the worth of electronic games as an educational tool for children, and examines the state-of-the-art of electronic games and their current availability. The first question is answered overwhelmingly in favor of making electronic games and toys widely available. The author places it in the context of the goal of educating a computer-literate generation. It is pointed out that developers of the fifth generation of computers contend that one of their main tasks is to make computers more 'human,' to break down the psychological barrier between them and users, and that this concern is being reflected now in the development of personal computers. Comments of academician Ye. Velikhov, vice-president of the USSR Academy of Sciences, are quoted in which he expressed the view that the main obstacle to new technology is the psychological barrier, and that to prepare for life in the 'information society' of the 21st century, questions of electronic games and personal computers for children must be carefully thought through and carried out now.

The article describes some electronic games that are currently on the market, and examines problems of making more and better ones available. Toy industry officials are quoted regarding lack of facilities and expertise to produce electronic products. The electronics industry, for its part, is said to lack suitable plastics for electronic toys. Another problem noted by the author is that educational psychologists and teachers have ignored the question of electronic games for children.

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INSTITUTE'S PROGRAM TO TRAIN ENGINEERS TO WORK WITH COMPUTERS

Kishinev SOVETSKAYA MOLDAVIYA in Russian 7 Sep 85 p 2

[Article by V. Malikova, correspondent)

[Excerpt] Specialists with higher educations have been invited to study at the Kishinev Polytechnical Institute. Applications are being taken here to a school for retraining of personnel in new and promising directions of science and technology. This division of the institute was created in consideration of requests from engineers of Moldavian enterprises. In lecture halls, these specialists will receive instruction in microprocessor systems and the automation of designing in the field of radioelectronic and computer technology.

"The need for this is dictated by the enhanced role of microelectronics and computer technology in technological progress as a whole, and in particular by the rapid advancement of instrument-building based on new components in our republic," said V. C. Antosyak, president of the institute.

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SPACE RESEARCH INSTITUTE HELPS CREATE HIGH SCHOOL COMPUTER CENTER

Kishinev SOVETSKAYA MOLDAVIYA in Russian 3 Sep 85 p 4

[Article by A. Tsyganov]

[Excerpt] Thanks to associates of the USSR Academy of Sciences' Institute of Space Research, exactly 100 desks have been equipped with computer terminals at Moscow Public School No. 117. Students in the higher grades at the school, which is located in Brezhnev Rayon, will study information science here.

"We decided we would build a true computer center when we received a directive from the presidium of the Academy of Sciences," said D. Kazimirov, one of the institute's leading specialists in computer technology, who headed up the work in creating the rayon's school center for computer training. "The school's electronic equipment is now in seven classrooms. Terminals connected with a computer are installed in one of these rooms, and there are personal computers in another room. A classroom has been equipped with a microcomputer for methodological experiments and for training teachers. Plans call for this microcomputer to be used for organizing the first management information system for the public education system.

"Experiments with the introduction of computer technology that have been done in Moscow, Novosibirsk, Leningrad and other cities have demonstrated that school children master the ABC's of working with computers in two or three months, and that they take an interest in solving classroom and practical problems."

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MINICOMPUTER 'SHATILI' FOR TRAINING IN SCHOOLS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 27 Sep 85 p 2

[Article by G. Namtalashvili, correspondent (Tbilisi)]

[Text] A small electronic machine called "Shatili" will help to solve the problem of furnishing secondary schools with computer equipment. It was developed at the special design bureau of scientific instrument building of the Georgian Academy of Sciences. The minicomputer can be used as a component of a terminal device intended for teaching principles of data processing and computer technology in grade schools and vocational schools.

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COMPUTER TRAINING AT AVIATION INSTITUTE

Moscow VOZDUSHNYY TRANSPORT in Russian No 95, 8 Aug 85 p 3

[Article by Ye. Kopytov, docent (Riga)]

[Excerpt] Hundreds of underclassmen of our institute studied microcomputer and minicomputer programming during the last academic year, using the facilities of a video-terminal class.

An automated teaching system called "Riga" was introduced in this class. This system was developed by specialists of Latvian State University.

The successful introduction of this class in the educational process was largely determined by the enthusiasm of instructors of the institute's chair of mathematical methods and programming, which is headed by Professor A. Andronov. The class' technology is operating reliably, thanks to the services of V. Kholkin, head of the higher school's computer center, and other specialists.

Students who are training to become mechanics, radio operators, electricians and economists will soon be studying their required disciplines with the aid of small computers.

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/12947
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STORY OF CONSTRUCTION INSTITUTE'S RESISTANCE TO COMPUTERIZATION

Moscow IZVESTIYA in Russian 27 Sep 85 p 2

[Article by F. Chernetskiy, correspondent (Odessa)]

[Abstract] The article relates the story of how a new department head at a civil engineering institute ruffled feathers by his attempt to have all calculations done in course work transferred to computers, which resulted in a conspiracy among the institute's faculty to discredit him and have him fired. The title of the article is "Adding Machine versus Computer, or the Case of Professor Avdeyev." It is recalled that Avdeyev was hired 10 years ago by the civil engineering institute in Odessa to head the chair of organization of construction. Two laboratories were placed under this chair of instruction. It is said that Avdeyev was chosen because of his solid experience both in construction organization and in computers and management systems. The article points out that at about the time he was hired, the construction industry was having its first experience with computerization of planning and management operations, and it was not progressing beyond such narrow applications as accounting and payroll-keeping. In his new job at the institute, Avdeyev sought to train construction industry managers who would bring computers to bear broadly on planning and organization.

Avdeyev's initiatives, however, required changing old ways of doing things at the institute, the article explains, and a resistance was mounted. He gained the further ire of the faculty when he discovered a shady dealing with a construction organization that was designed to bring extra bonuses to certain faculty members, and he went beyond the institute's administration to have it investigated. In subsequent charges and hearings that resulted from the effort to get Avdeyev fired and his defense of himself, the whole affair reached such instances as local Communist Party committees and the republic ministry of higher education. In the final outcome of the matter, the article reports that Avdeyev is now teaching at another institute, and the civil engineering institute's president lost his job, but the old way of teaching there hasn't changed.

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USE OF SATELLITES IN MEDIUM-ALTITUDE ORBIT FOR ORGANIZATION OF REGIONAL COMPUTER NETWORKS

Kiev UPRAVLAYUSHCHIYE SISTEMY I MASHINY in Russian No 4, Jul-Aug 85 (manuscript received after revision 15 Jan 85) pp 45-48

[Article by S. G. Bunin, Institute of Cybernetics, Ukrainian Academy of Sciences]

[Abstract] Satellite communications for radio, TV or telephone now generally use satellites in stationary or high-altitude orbits and are intended to cover the largest possible surface without interruptions or at least for long periods, but their cost is high because of the complexity of the satellites with the repeater which must be orbited by multi-stage rockets and then be correctly oriented and stabilized. Since the retransmission is weak the ground stations must be able to handle signals in some cases reduced in power by a factor of 10^{20} while the satellite has a life-span of only 3-7 years. For design purposes, a satellite link channel is considered equivalent to a ground link 1-5000 km long and a satellite link is economical only when it costs less than such a ground link. Unlike communication satellites, computer networks allow interruptions in flow and temporary data storage while data flows are most intense where client density is greatest (regional networks) and stationary and high-altitude systems are not economical here. It is shown that low- and medium- circular and elliptical orbits are suitable for regional data networks and that for data communications conditions orbits at altitudes of 1.5-5000 km allow maximum transmission and simplification of the equipment while the cost of transmission of one bit is minimal at altitudes of approximately 5000 km. The disadvantages are Doppler effects due to satellite speeds and the need for tracking procedures to reduce noise. In April-May 1983 data was experimentally transmitted by a Radio series satellite between Moscow and Kiev and the results confirmed expectations. The area covered can be increased by satellite repeaters or by onboard storage of data which can be read when convenient from the ground. Satellites could serve several different local networks and retransmit from one to another. Reliability can be increased by signal regeneration onboard. Figures 2; references: 3 Russian, 1 Western.
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TEXTBOOK ON OPTICAL SYSTEMS THEORY MERITS AWARD NOMINATION

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 6 Sep 85 p 2

[Article by A. Prokhorov, academician]

[Excerpt] When talking to operators of the long-distance telephone exchange, residents of Gorkiy have no notion that their conversations are being transmitted through an optical fiber instead of a conventional electric cable. Similar optical-fiber lines are operating in Moscow and Leningrad. They have appeared as a result of the creation of an optical and optoelectronic instrument-building industry.

The growing role of optical and optoelectronic instrument building in the acceleration of scientific-technical progress requires that skilled engineers and scientists be trained. Every year, higher schools of our country graduate hundreds of specialists in various fields of optics. Technical progress imposes rigid demands on the training of engineers.

Modern instructional literature, particularly in the newest branches of knowledge, is very important for radically improving the quality of training. Scientists B. Begunov, N. Zakaznov, S. Kiryushin and V. Kuzichev have written just such a textbook, which is essential for higher educational institutions as well as institutes for advanced training of specialists.

The textbook Theory of Optical Systems (Teoriya opticheskikh sistem), which has been published by the "Mashinostroyeniye" (machine building) publishing house, is written on a high ideological, scientific and methodological level. It ensures creative and active mastery of theoretical knowledge and practical skills by students. At an all-Union seminar for heads of chairs of instruction that train optics and optoelectronics specialists in fields where acute shortages of personnel exist, it was noted that this textbook meets new demands on the knowledge and qualifications of personnel. The textbook has been deservedly admitted to the competition for the USSR State Prize.

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ONE APPROACH TO MATHEMATICAL SIMULATION OF DATA TRANSMISSION AND PROCESSING IN COMPUTER NETWORKS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian No 5, Sep-Oct 85
(manuscript received 11 Jul 83, after revision 24 Nov 83) pp 26-32

[Article by A. G. Adler and Yu. G. Savchenko]

[Abstract] A computer network is simulated with an open queueing system whose components are models of the primary elements of the computer net: the central processor, input/output hardware and the data source. The major task in the analysis of such an open network with a serial demand flow through the primary elements is the determination of the parameters of the flow exiting the component in operation; these parameters are also those of the input flow to the next component. An earlier paper applied Berke's theorem to the description of such an open queueing system only for the case of two centers with an exponential distribution of the service times and an initial Poisson flow. This paper treats an open network with an arbitrary number of centers and a general form of the probability distribution density of the service times, where the input flow also has the general form of the probability distribution density of the serial demands. It is assumed that the probability distribution density of the time intervals between the arrival times of the serial demands at the input to the operating component of the queueing system and the same parameter of the time intervals for the servicing of the serial demands in this component are specified. General theorems derived from this model are applied to the evaluation of the quality and the selection of the computational process configuration for noise immune, remote intermachine exchange with both software and hardware implementation of the noise immune coding and decoding procedures for data transmission via communications channels between the CPU's in the net. The mean demand interrupt times in the network elements are also determined for these two cases. The hardware configuration of an automated process control system for a hot rolling mill producing thick sheet steel, based on the YeS-1033 computer, is briefly described and no detailed numerical examples or technical specifications are provided. Figures 1; references 4: 3 Russian, 1 Western in Russian translation.
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